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Ripley (L. B.) & Hepburn (G. A.). **Olfactory Attractants for Male Fruit-flies.**—*Ent. Mem. Dep. Agric. S. Afr.* no. 9 pp. 3–17. Pretoria, 1935.

The following is based on the authors' summary of further investigations in South Africa on the olfactory reactions of *Ceratitis* (*Pterandrus*) *rosa*, Ksh., and other fruit-flies [*cf. R.A.E.*, A **19** 707, etc.]. Fruit-flies are probably attracted to fruits and fermenting baits by composite odours rather than by any one chemical compound. As no chemical has been found more attractive to females than pollard bait, attention has been directed to male attractants. A list is given of 17 male attractants, including 6 pure compounds, arranged in order of relative attractiveness to *C. rosa* in the field when compared at their optimum concentrations, which have been determined for 12 of them. The diluent was refined whale oil. African copaiba oil (66 per cent.), terpinyl acetate (17), caryophyllene from clove oil (9), and "clove terpenes," which are largely caryophyllene (33), were powerful attractants. There was no correlation between degree of attractiveness of the compounds and their optimum concentrations. They have little or no similarity in odour, and the pure chemicals are alike only in being either hydrocarbons or esters.

Lists are given of 13 species of Trypetids the males of which were attracted to terpinyl acetate, of 27 species readily attracted to pollard bait that were not affected by terpinyl acetate, and of the few species trapped by other male attractants in limited experiments. The positive response to terpinyl acetate of the various species tested appears to follow their natural relationships: all species of *Ceratitis* and some of allied genera were attracted, while no species of other subfamilies have been trapped by any of the male attractants. The relative attractiveness of the various chemicals apparently varies according to the species. *C.* (*P.*) *rubivora*, Coq., was attracted by all the compounds which affected *C. rosa*, but *C. capitata*, Wied., and *C. rosa* differed widely in the degree to which they responded to paraffin oil. The attraction to male attractants is of a distinctly different type from that to food odours, and the conditions under which it operates are much more restricted. In the laboratory the males are strongly repelled by these attractants.

Strong male attractants should not be rejected as useless in control work until the biological factors that determine their value have been studied. In areas where trapping is the principal method of fruit-fly control, terpinyl acetate as well as pollard bait is suggested for trapping *C. rosa*, as it is much more powerful than the latter. The acetate should be diluted with whale oil or a vegetable oil and a film about $\frac{1}{4}$ in. thick floated on water in the traps, and renewed every fortnight. No poison is required. Terpinyl acetate is very efficient for flies emerging in the orchard, but less so for invading flies, most of which are females. In six months 58,500 males of *C. rosa* were caught in 120 traps baited with terpinyl acetate in a sub-tropical fruit orchard near Durban. Such trapping is also useful as a guide to the spray programme for *Citrus*.

Munro (H. K.). **Biological and Systematic Notes and Records of South African Trypetidae (Fruit-flies, Diptera) with Descriptions of New Species.**—*Ent. Mem. Dep. Agric. S. Afr.* no. 9 pp. 18–55, 10 figs. Pretoria, 1935.

Notes are given on the host-fruits and distribution of a large number of Trypetids, and 10 new species (2 belonging to a new subgenus) and

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1 new variety are described. The species reared from cultivated fruits are *Ceratitis capitata*, Wied., from grapefruit (a new record for South Africa [*cf. R.A.E.*, A **18** 420]), coffee berries, and pears, *C. rosa*, Ksh., from pears, quinces and blackberries, *C. rubivora*, Coq., from blackberries, and *C.* (*Trirhithrum*) *nigerrima*, Bezzi, from coffee berries. *Dacus pectoralis*, Wlk., which usually attacks cucurbits, was reared from a fruit of *Sphaerosicyos sphaericus*. An alphabetical index to the species of fruit-flies and a systematic index to the plants, showing the flies that attack them, are appended.

JACK (R. W.). **The Report of the Chief Entomologist for the Year ending 31st December, 1934. Agricultural.**—*Rhod. agric. J.* **32** no. 8 pp. 558–566; also in *Bull. Minist. Agric.* [*S. Rhodesia*] no. 962, pp. 1–9. Salisbury, August 1935.

Many of the pests recorded in Southern Rhodesia in 1934 have already been noticed [*cf. R.A.E.*, A **23** 445, 409, 250, etc.]. The following parasites of *Nomadacris septemfasciata*, Serv., were found during the year: *Pulicophora rhodesiana*, Schmitz, which was reared from decomposing egg-pods; the egg-parasite, *Scelio howardi*, Crwf.; and *Fannia canicularis*, L., *Muscina stabulans*, Fall., *Sarcophaga beckeri*, Villen., *S. exuberans*, Pand., *S. nodosa*, Engel, *S. villa*, Curran, and the Phorid, *Diploneura armipes*, Brues, all of which were reared from decomposing adults. Pests of stored products included *Lasioderma serricorne*, F., which occurred in stored tobacco in 9 warehouses, and a beetle, probably *Alphitobius laevigatus*, F. (*piceus*, Ol.), which was found in a maize bin. A dead adult of *Gnathotricus materiarius*, Fitch, was found in imported Canadian spruce. Growing tobacco was considerably damaged by *Pheidole* sp., which carried away germinating seeds. *Agonoscelis erosa*, Westw., slightly injured twigs of *Citrus* in one locality, and *A. versicolor*, F., caused numbers of the fruits to drop in another. *Empoasca facialis*, Jac., was more injurious on cotton than usual. Maize and sunn hemp [*Crotalaria juncea*] were considerably damaged by *Cantharis brevipennis*, Haag., and *Exora discoidalis*, Jac., and wheat and barley by the larvae of *Cirphis loreyi*, Dup., 10 per cent. of which were parasitised by *Sturmia laxa*, Curran, and two other Tachinids. In the eastern districts, *Aphis maidis*, Fitch, and *Toxoptera graminum*, Rond., injured young wheat and barley during April and June. Pests of vegetables and ornamental plants included *Thrips tabaci*, Lind., which severely injured onions; *Aphis laburni*, Kalt., on butter beans in July; *Epimadiza hirta*, Mall., which infested *Gladiolus* plants from September to November; and the Sphegid, *Crabro* (*Dasyproctus*) *bipunctatus*, Lep., which bored holes in the flowering stems of *Gladiolus* and provisioned the resulting nest with Muscid flies. Among pests of fruit other than *Citrus* were *Aulacaspis cinnamoni*, Newst., and *Agonoscelis puberula*, Stål, on mango; *Schizonycha manicana*, Péring., which injured apple blossoms in November; and *Omophorus stomachosus*, Boh., on cultivated figs. Miscellaneous insect records (not all made in the year under review) include *Trialeurodes mossopi*, Corb., which infests beans in sheltered places during the winter and is parasitised to a small extent by *Prospaltella* sp.; *Laphygma leucophlebia*, Hmps., which attacks tobacco seedlings; and *Colasposoma amplicolle*, Lef., which damages the tops of young cypress trees (*Cupressus lusitanica*) and *Eucalyptus* sp.

EGGERS (H.). **Neue Borkenkäfer (Ipidae Col.) aus Afrika. Nachtrag VI.** [New Scolytids from Africa. Supplement VI.]—*Rev. Zool. Bot. afr.* **27** fasc. 2 pp. 295–311. Tervueren, 25th September 1935.

The new species described include *Stephanoderes attenuatus* from branches of cola in Sierra Leone and also found in the Belgian Congo, and *Xyleborus aegir* from a wound on a coffee stem in Tanganyika Territory.

SHAFIK (M.) & AMER (A. A.). **Efficiency of commercial Sodium Cyanide and Sulphuric Acid in liberating Hydrocyanic Acid Gas for Fumigation.**—*Bull. Minist. Agric. Egypt* no. 160, 6 pp., 2 figs., 7 refs. Cairo, 1935.

The fumigation of *Citrus* trees against *Chrysomphalus ficus*, Ashm., is carried out in Egypt by the pot method of producing hydrocyanic acid gas, in which sodium cyanide, commercial sulphuric acid and water are used in the ratio 1 : 1·25 : 2. Experiments were made to determine the efficiency of various ratios, and it was found that smaller quantities of acid and water gave better results. Since slight inaccuracies of measurement affect the efficiency considerably, the safe ratio of 1 : 0·9 : 1·6 is recommended for field work.

NOTLEY (F. B.). **Leaf-eating Caterpillar of Coffee** (*Metadrepana andersoni* **Tams**).—*E. Afr. agric. J.* **1** no. 2 pp. 119–126, 12 figs. Nairobi, September 1935.

Epicampoptera (*Metadrepana*) *andersoni*, Tams, was first observed on coffee in Kenya in 1922 [*cf. R.A.E.*, A **13** 108, etc.] and has since been found in various parts of the Nyanza Province and the Trans Nzoia and in Uganda. Outbreaks, though usual between July and November, have occurred in every month of the year. The insect probably maintains itself normally on some indigenous food-plant. The eggs are laid singly, usually on the lower surface of the leaf, and hatch in 8 or 9 days. The larva feeds on the leaves for 28–30 days and pupates in a rolled leaf. The adult emerges 12–14 days later. The moths rest on the underside of the leaves during the day and pair about a day after they emerge. Oviposition begins immediately afterwards. In captivity most eggs are laid the first night, but oviposition may continue for 5 nights, after which the female dies. Unfed females laid an average of 76 eggs and females fed on sugar an average of 109.

Where sprays have not been applied, outbreaks have resulted in the defoliation of 50–150 acres of coffee, and though the insect eventually disappears, apparently owing to the action of natural enemies, the trees do not yield a good crop for several years. The natural enemies that have been identified have already been noticed [**23** 379]. The most important are probably Hymenopterous egg parasites, and Rhynchota, particularly *Glysus vigil*, Germ., which are predacious on the larvae. For control it is essential to spray both infested and surrounding areas before the infested area has become large with either 5 lb. lead arsenate powder or 1 lb. Paris green and 5 lb. air-slaked, or preferably dry water-slaked, lime in 200 gals. water or Bordeaux mixture. The sprays

should be applied at the rate of 100 gals. for 200–300 average trees. When complete defoliation has occurred, the trees should be allowed to recover before they are stumped or pruned.

STOREY (H. H.). **Virus Diseases of East African Plants: II—Leaf-curl Disease of Tobacco.**—*E. Afr. agric. J.* **1** no. 2 pp. 148–153, 6 figs., 128 refs. Nairobi, September 1935.

Leaf-curl of tobacco occurs in Uganda, Tanganyika, Zanzibar, Nyasaland, Southern Rhodesia, South Africa, the Belgian Congo and other parts of West Africa. The disease, which is sometimes very injurious and sometimes mild, is recognised by the presence of enations filled with chlorophyll on the smaller veins on the lower surface of the leaves. It cannot be transmitted by inoculation of sap, nor is it carried in the seeds. An Aleurodid of the genus *Bemisia*, close to or identical with *B. gossypiperda*, Misra & Lamba, which oviposits on the leaves and is the only vector known, has been shown to transmit the virus in experiments (some of which have not been published) in South Africa and Nyasaland [*cf. R.A.E.*, A **20** 620] as well as at Amani [**20** 330] and in Southern Rhodesia [*cf.* **21** 61]. The virus is apparently distinct from that causing leaf-curl of cotton, or at any rate is not transmissible to cotton from tobacco [*cf.* **21** 106]. Cultural measures [*cf* **21** 62] are the most promising methods of control. So far attempts to breed immune varieties have been unsuccessful.

COTTIER (W.). **Aphides affecting cultivated Plants. (3) Aphides of the Rose, Chrysanthemum, and** *Elaeagnus*.—*N. Z. J. Agric.* **50** no. 6 pp. 353–358, 1 fig. Wellington [N. Z.], 20th June 1935. **(4) Aphides of the Peach, Plum, and Apple.**—*Op. cit.* **51** no. 1 pp. 26–31, 3 figs. 20th July 1935.

In these papers, which belong to a series [*cf. R.A.E.*, A **23** 422, 507], brief notes are given on the appearance, bionomics and, if known, the alternative food-plants in New Zealand of *Capitophorus rosarum*, Kalt., *C. tetrarhodus*, Wlk., *Macrosiphum rosae*, L., and *M. solanifolii*, Ashm. (*gei*, auct.) on roses; *Macrosiphum* (*Macrosiphoniella*) *sanborni*, Gill., and *Anuraphis padi*, L. (*helichrysi*, Kalt.) on chrysanthemums; *Capitophorus braggi*, Gill., on *Elaeagnus*; *Myzus persicae*, Sulz., *Anuraphis persicae-niger*, Smith, and *A. schwartzi*, Börner, on peach; *Rhopalosiphum nymphaeae*, L., on plum and apricot; and *Eriosoma lanigerum*, Hsm., and *Aphis pomi*, DeG., on apple.

Aphids are controlled on fruit trees either by means of tar distillate sprays in the dormant season or by a contact insecticide, such as 1 pint nicotine sulphate and 2–3 lb. soap in 100 gals. water, in the growing season. In the southern districts of South Island, *M. persicae* is known to overwinter in the egg stage on peach trees and is controlled by tar distillates (1 : 30) applied in the true dormant period. This spray can also be used against the eggs of *A. schwartzi*, and against those of *R. nymphaeae* on plum. Spraying can be carried out from June onwards but must be finished before the buds show any signs of movement. Contact insecticides should be applied in the spring, when the young succulent growth is often stunted by the feeding of Aphids. Since the introduction of *Aphelinus mali*, Hald., *E. lanigerum* has ceased to be a serious pest.

GLOVER (P. M.). **An Account of the Occurrence of** *Chrysomphalus aurantii*, **Mask. and** *Laccifer lacca*, **Kerr on Grape Fruit in Ranchi District, Chota Nagpur, with a Note on the Chalcidoid Parasites of** *Aspidiotus orientalis*, **Newst.**—*J. Bombay nat. Hist. Soc.* **38** no. 1 pp. 151–153, 1 pl., 8 refs. Bombay, 15th August 1935.

Aonidiella (*Chrysomphalus*) *aurantii*, Mask., the female of which is briefly described, has been recorded in India on grapefruit, orange, mulberry, guava and a few ornamental plants, but in no case as a serious pest. Grapefruit in the Ranchi district is often lightly and roses occasionally severely attacked. A few one year old grafts of a variety of grapefruit, which had been planted in June 1930, were infested in March 1931. Sprays were applied then and again in January 1933 when re-infestation was observed. One plant was lightly infested with *Laccifer lacca*, Kerr, which had apparently migrated from *Zizyphus jujuba*. Of the sprays used, lime-sulphur killed both Coccids but scorched the foliage severely. A spray similar to one already noticed [*R.A.E.*, A **17** 504] consisting of 1 lb. resin and 3 lb. crude castor oil heated together and, when cool, stirred into 18 gals. water containing $1\frac{1}{4}$ lb. ammonia (specific gravity 0·888) was fairly satisfactory. The most effective spray was made up of 2 gals. kerosene oil, $\frac{1}{2}$ lb. soap and 1 gal. soft water diluted with 9 gals. water for use.

Parasites reared from *Aspidiotus orientalis*, Newst., on *Z. jujuba* at Namkum were the Aphelinids, *Aphytis chrysomphali*, Merc., which is probably recorded from India for the first time, and an adult of which was also taken on a twig infested with *Aonidiella aurantii*, *Marietta javensis*, How., which is a hyperparasite of primary Chalcidoid parasites of *Aspidiotus* and was previously reported as *Perissopterus* sp. [**22** 166], and *Physcus* sp. (near *flaviventris*, How.), which was rather rare ; the Eulophid, *Tetrastichus purpureus*, Cam., which was a primary and probably also a hyperparasite ; and the Encyrtid, *Comperiella bifasciata*, How., which was common and is recorded from India for the first time.

TSAI (Pang-hwa) & CHANG (Yen-nien). **Experimental Studies regarding the Influence of Temperature and relative Humidity on the Oviposition of the Rice Weevil** (*Calandra oryzae* **L.).** [*In English and Chinese.*]—*Agric. sinica* **1** no. 6 pp. 175–188, 5 figs., 10 refs. Nanking, May 1935. [Recd. September 1935.]

The following is taken from the authors' summary of studies in China on the effect of temperature and humidity on oviposition in *Calandra oryzae*, L. The range for oviposition was 10–35°C. [50–95°F.] and 60–100 per cent. humidity. The vital optimum (highest number of eggs) was 24–29°C. [75·2–84·2°F.] and 90–100 per cent. humidity. The maximum rate of oviposition was at 26–32°C. [78·8–89·6°F.] and 90–100 per cent. humidity. Maximum longevity occurred below 16°C. [60·8°F.] and at 85–100 per cent. humidity. As the temperatures for vital optimum, maximum longevity, and maximum rate of oviposition are slightly higher in *C. oryzae* than in *C. granaria*, L. [*cf. R.A.E.*, A **22** 484], the former is more common in southern countries, but it has been found in China as far north as 41°N. lat. and as far south as Canton (23°N.). Outbreaks can be controlled by maintaining the temperature in the store below 10°C. [50°F.] or above 35°C. [95°F.] or the humidity at less than 60 per cent.

Ku (Yuang). **The Use and Property of Nao-yang-wha** (*Rhododendron hunnewellianum*) **as an Insecticide.** [*In Chinese.*]—*Ent. & Phytopath.* **3** no. 16 pp. 328–330. Hangchow, 1st June 1935. (Abstr. in *Lingnan Sci. J.* **14** no. 4 p. 735. Canton, 4th October 1935.)

Rhododendron hunnewellianum contains andromedotoxin and an unidentified compound, both effective insecticides. Preparations made from the plant, whether contact insecticides, stomach poisons or fumigants, paralyse insects, the injury spreading from the posterior to the anterior end. They are especially recommended as stomach poisons, and three formulae are given.

Chu (Joo-tso), Chin (Shing-mu), Ku (Tan) & Hu (Yung-hsi). **An investigational Report on the Mulberry Insects of Kiangsu and Chekiang in the Winter of 1934.** [*In Chinese.*]—*Ent. & Phytopath.* **3** no. 18 pp. 354–363. Hangchow, 21st June 1935. (Abstr. in *Lingnan Sci. J.* **14** no. 4 pp. 724–725. Canton, 4th October 1935.)

This paper records the distribution in Kiangsu and Chekiang of the important mulberry pests, which include the Lamiids, *Apriona rugicollis*, Chevr., *Olenecamptus clarus*, Pasc., *Psacothea hilaris*, Pasc., and *Melanauster chinensis*, Forst., the Cerambycid, *Xylotrechus chinensis*, Chevr., the weevil, *Baris deplanata*, Roel., the Lymantriid, *Arctornis chrysorrhoea* var. *xanthocampa*, Dyar, the Noctuid, *Acronycta major*, Brem., the Psychid, *Eurukuttarus nigriplaga*, Wilem., the Geometrid, *Hemerophila atrilineata*, Butl., the Pyralid, *Margaronia pyloalis*, Wlk., the Bombycids, *Bombyx* (*Theophilia*) *mandarina*, Moore, and *Rondotia menciana*, Moore, and the Coccids, *Ceroplastes floridensis*, Comst., *Drosicha contrahens*, Wlk., and *Aulacaspis* (*Sasakiaspis*) *pentagona*, Targ.

Stearns (L. A.), Williams (L. L.) & Haden (W. R.). **Control of the Plum Curculio in Delaware.**—*Bull. Del. agric. Exp. Sta.* no. 193, 28 pp., 9 figs., 4 refs. Newark, Del., April 1935. [Recd. September 1935.]

The life-history of *Conotrachelus nenuphar*, Hbst. (plum curculio) in Delaware is outlined [*cf. R.A.E.*, A **21** 47] and the results of investigations during 1930–32 are described. In the southern part of the State the first adults emerged on 15th and 21st April in 1930 and 1931 respectively, whereas in the northern part the corresponding dates were 5th and 14th May. The delay corresponds closely to the early seasonal difference in peach development in the two districts. The spray programme for peaches consists of 3 applications of 2 lb. lead arsenate and 8 lb. hydrated lime per 100 U.S. gals. water. The first is applied when the majority of the petals have dropped, the second when half of the peach is exposed by the slipping of the shuck, and the third 2 weeks later. They are especially designed to combat the adults emerging from hibernation. When the peach crop is light, serious injury to apple can be prevented by including lead arsenate (3 lb. per 100 U.S. gals.) in the pre-blossom and petal-fall sprays on apple. In southern Delaware where a large population is being steadily built up owing to a partial second generation [**23** 599], spraying alone will probably not be

sufficient and supplementary measures are essential. Areas adjoining the orchards which provide suitable cover for hibernation should be burnt over in February or March [*cf.* **21** 225], jarring should be carried out during the period of maximum emergence, and the marginal part of the orchard should be sprayed first if there is any delay in spraying the whole orchard. Fallen peaches should be destroyed during the last week of May and the first of June, and when infestation is severe in the second week of June also, and the orchard should receive frequent and thorough disking during the rest of the month to destroy the pupae. If the infested peaches are buried, they must be at a depth of at least 36 ins., and they should be covered with a layer of quicklime or paradichlorobenzene [*cf.* **20** 429]. Storing the infested fruit in tight metal containers until the larvae are dead or dumping them in a large pit and covering them with used crank-case oil has proved effective.

HADEN (W. R.). **Parasitism of the Oriental Fruit Moth with special Reference to the Importance of certain Alternate Hosts.**—*Bull. Del. agric. Exp. Sta.* no. 194, 42 pp., 8 figs., 5 refs. Newark, Del., January 1935. [Recd. September 1935.]

In Delaware, the larvae of the first three generations of *Cydia* (*Grapholitha*) *molesta*, Busck, chiefly infest the twigs and fruit of peach, and those of the fourth severely injure the maturing apple crop.

The parasites attacking the larvae of the first three broods in peach twigs and the two alternative hosts, *Epiblema strenuana*, Wlk., on ragweed [*Ambrosia*] and *Ancylis comptana*, Fröl., on strawberry, were studied during the years 1931–1934. The results obtained by workers in other parts of the United States in rearing parasites from these hosts are discussed, and details are given of the methods and materials used in the Delaware studies. The data obtained concerning the parasites attacking each of the hosts and the relative degree of parasitism caused by each of them in each brood for each year are analysed first separately, then collectively. Of the 35 species reared from the larvae and pupae of the three moths, 10 were common to *C. molesta* and *E. strenuana*, which feed similarly within the stems of their food-plants, 6 to *C. molesta* and *A. comptana*, 4 to *E. strenuana* and *A. comptana*, and 3 species, *Macrocentrus ancylivorus*, Rohw., *M. delicatus*, Cress., and *Microbracon gelechiae*, Ashm., to the 3 hosts. The somewhat more active larvae of *A. comptana* feed within the folded leaves of the strawberry plant and are probably less accessible to parasites.

Although *M. ancylivorus* is the most effective parasite of *C. molesta* and one of the two most important species affecting *A. comptana*, particularly in the southern section of Delaware, it was reared only occasionally from *E. strenuana*. *Cremastus cookii*, Weed, the other abundant parasite of *A. comptana*, was not recovered from the other two hosts. *M. delicatus* and *Glypta rufiscutellaris*, Cress., the chief parasites of *E. strenuana* were reared in exceedingly small numbers from *C. molesta*. *G. rufiscutellaris* was never reared locally from *A. comptana*, and *M. delicatus* was reared only occasionally.

From the data presented it appears that the presence of *E. strenuana* and *A. comptana* has had no appreciable effect up to the present upon the natural control of *C. molesta* by parasites in Delaware. Of the larvae of the latter in peach twigs, the percentages parasitised in the four years were 50·04, 57·9, 64·08 and 67·56.

Directory of the Bureau of Entomology and Plant Quarantine 1935.—*Misc. Publ. U.S. Dep. Agric.* no. 220, 88 pp., 1 map, 1 fldg diagr. Washington, D.C., April 1935. [Recd. September 1935.]

This directory gives a brief statement of the functions of the Bureau of Entomology and Plant Quarantine of the United States Department of Agriculture and its several divisions, with the names and addresses of the administrative leaders. A list of laboratories, offices and field headquarters is arranged alphabetically by States, and in addition to the name of the officer in charge and the address, a brief statement is included of the work conducted at each. Indices of personnel and of the field laboratories and offices maintained by the various divisions are appended.

Frear (D. E. H.) & Worthley (H. N.). **Study of the Removal of Spray Residues from Apples.**—*J. agric. Res.* **51** no. 1 pp. 61–74, 7 refs. Washington, D.C., 1st July 1935.

The following is taken from the author's summary of washing experiments carried out in Pennsylvania in 1934 for the removal of arsenic and lead from apples sprayed with lead arsenate. The removal of arsenic and lead increased with the concentration of hydrochloric acid, but a higher concentration removed proportionately greater amounts of arsenic than lead. The concentration removing both in equivalent quantities was about 2 per cent. by weight. Wetting agents scarcely increased the efficiency of hydrochloric acid solutions in a flotation washer at room temperature. The underbrush washer was slightly more effective than the flotation one. The difficulty of residue removal varied with the variety of apple. A 1 per cent. hydrochloric acid solution at 100°F. was about as effective as a 2 per cent. solution at 60°. The addition of salt did not increase the efficiency of acids nor were mixed hydrochloric and nitric acid solutions, sodium carbonate, or soap and sodium silicate so efficient as dilute hydrochloric acid alone. The deposit from sprays containing skim milk spreader was removed more easily and from sprays incorporating fish oil less easily than from other combinations.

Shapovalov (M.). **Graft versus Insect Transmissions of Curly Top in Tomatoes (Tomato Yellows).**—*Phytopathology* **25** no. 9 pp. 844–853, 2 figs., 6 refs. Lancaster, Pa, September 1935.

An account is given of experiments in the United States which showed that grafting to obtain experimental infection of tomatos with curly-top cannot take the place of the standard inoculation method with *Eutettix tenellus*, Baker, if simplicity and promptness are desired. For the best graft transmission it was necessary for the diseased plants to be in a very early stage of the disease, which involved a preliminary insect inoculation, and even then a variable number of plants failed to acquire the virus.

Severin (H. H. P.) & Freitag (J. H.). **California Celery Mosaic Diseases. (Abstract.)**—*Phytopathology* **25** no. 9 p. 891. Lancaster, Pa, September 1935.

Ten species of Aphids [the names of which are not given] are vectors of the two celery mosaic diseases that occur in California, western

celery mosaic and celery calico, and five of them are known to breed on celery in nature. *Aphis gossypii*, Glov., transmitted the virus of both diseases when healthy individuals were allowed to feed for 5 minutes on diseased plants and then, for the same length of time, on healthy ones. Large populations of different species of Aphids reared on plants attacked by western celery mosaic and transferred daily to healthy celery transmitted the virus on the first but not on subsequent days.

Dana (B. F.) & McWhorter (F. P.). **An Outbreak of Curly Top on Pansy. (Abstract.)**—*Phytopathology* **25** no. 9 p. 894. Lancaster, Pa, September 1935.

An important pansy-seed industry in Oregon was threatened in 1934 by a serious outbreak of curly-top, 20 per cent. of the plants in a 5-acre field showing severe injury in July. Adults and nymphs of *Eutettix tenellus*, Baker, which was presumably the vector, were abundant on all plants examined. Plants grown from seed produced by diseased plants were healthy.

Fleming (W. E.) & Baker (F. E.). **The Use of Carbon Disulphide against the Japanese Beetle.**—*Tech. Bull. U.S. Dep. Agric.* no. 478, 91 pp., 40 figs., 166 refs. Washington, D.C., July 1935.

Experiments with carbon bisulphide have been carried out by the authors and other investigators in the United States during 1920–31 to determine its effectiveness in destroying the immature stages of *Popillia japonica*, Newm., under different conditions. The results of some phases of this investigation have been published, and the methods developed have long been in commercial use [*R.A.E.*, A **12** 48; **13** 339, 568; **18** 354; **20** 681; **22** 571, etc.]. This bulletin combines published and unpublished data in a detailed review of the main aspects of the work. The chemical properties of carbon bisulphide are discussed, the method of preparing emulsions is described, and the relative toxicity of vapour and emulsion to the different stages of *P. japonica* and the effect of the chemical on soil and on vegetation are indicated. The commercial and chemically pure grades were found to be equally effective, but when in emulsion carbon bisulphide proved only about half as toxic as the same quantity in the form of vapour; the lower toxic value of the emulsified form was attributed to the lowered volatility of the compound and the relative inactivity of the larvae when submerged. The type and concentration of the emulsifier modified to some extent the insecticidal value of the dilute emulsions.

An account is given of a number of types of experiments with carbon bisulphide as a fumigant for the soil in pots, in heeling and plunging beds, and round the roots of evergreens and nursery stock. In experiments with emulsified carbon bisulphide the soil round the roots of plants was submerged, dilute emulsion was poured about the roots of potted plants to destroy the larvae, and the ground about the roots of nursery plants was flooded. Dipping in dilute emulsion was successful with certain deciduous plants, but proved injurious to evergreens. The application of such an emulsion to the soil about the roots was, however, successful in destroying the immature stages of *P. japonica* without causing serious injury to either evergreen or deciduous plants.

A list is given of the ornamental plants successfully treated with emulsified carbon bisulphide. The treatment of grassland with the emulsion, and the use of carbon bisulphide as a fumigant for raspberries and other fruits against the adult beetles [**22** 571] are also dealt with, and the conditions of certification for shipment of nursery stock and crated berries outside the quarantine zone are summarised.

GRAHAM (S. A.). **The Spruce Budworm on Michigan Pine.**—*Bull. Sch. For. Mich.* no. 6, 56 pp., 1 pl., 8 figs. Ann Arbor, Mich., 1935.

The following is taken from the author's summary : Since 1923 outbreaks of *Tortrix* (*Harmologa*) *fumiferana*, Clem. (spruce budworm) on jack pine [*Pinus banksiana*] have occurred periodically in the Great Lakes Region of the United States. In 1933 the most serious infestation yet known broke out in a national forest. Less severe outbreaks and evidence of previous heavy infestation can be observed throughout the area occupied by jack pine. The outbreak is built up on the infested area and not increased by invasions from distant sources. The effects of defoliation are largely local, and the tops of the trees are often killed because the larvae concentrate there while the rest of the tree survives. A very heavy outbreak in 1929 resulted in the death of only 13 per cent. of the trees, but an additional 17 per cent. became " stag-headed " as a result of the injury. The injury to young growth of trees planted under or near infested trees may be erroneously attributed to suppression. As the budworm feeds on both female flowers and young cones, it may be responsible for a temporary seed shortage. The eggs are deposited on the needles in elongated clusters in late July and August. The larvae hatch in about a week, and, without eating, spin cocoons and hibernate in protected places under bark scale, etc. In spring they feed first on any available pollen, which appears to be especially important in the diet of very young larvae, and then mine into the expanding needles and feed on the surface of expanding buds, and later on the basal part of the needles. Unless numerous, they feed only on new growth, but when they are more abundant the older larvae may also feed on the older foliage. The pupae occur under the larval webs, and the moths emerge in July. The sex ratio is altered by a scarcity of food, probably owing to the greater food requirements of the female. In some heavily defoliated areas the percentage of females was reduced from the normal (50–63) to 26 or even 10. The taller the trees and the closer the young stands are to larger trees, the more susceptible they are.

All pines commonly grown in the Lake Region are subject to attack. Scots pine [*Pinus sylvestris*] is the most susceptible, followed by jack pine and Norway spruce [*Picea abies*]. White pine [*Pinus strobus*] is seldom severely attacked. Except in certain plantations of Scots pine the heaviest infestations invariably occur on or under large-crowned, orchard-type trees or on over-mature round-crowned trees, owing to the excessive production of male flowers and hence favourable feeding conditions. The production of male flowers depends on an excess of available carbon over nitrogen, and trees on poor soil and suppressed trees are likely to produce more male flowers. Defoliation changes the carbon-nitrogen ratio by cutting down the amount of foliage, and so the budworm produces unfavourable conditions for itself. This probably explains the greater severity of outbreaks on fir [*Abies*] than on jack pine. On Scots pine the larvae feed successfully on the foliage

buds and, though they prefer pollen, they can build up epidemic populations without it. Trees on which the buds open first are the most severely injured. One female may produce as many as 316 eggs or more. With 63 per cent. females, the biotic potential is about 200. In spite of a 96 per cent. reduction of potential population, the numbers of budworms on a certain area of a national forest in 1934 was more than 8 times as great as in 1933. Apparently a reduction in either the ratio or egg production of females, which may be brought about by unfavourable food conditions, is more important than losses in larvae and pupae.

Recommendations for control include maintenance of dense stands by close planting, removal of large crowned, orchard-type trees and over-mature round-crowned trees, which will reduce the number of male flowers, filling in undesirable openings, and removal of trees on the margins of stands near susceptible trees, together with young trees produced naturally and susceptible trees. Restocking after removing or felling trees is advised.

MACKIE (D. B.). **Entomological Service.**—*Mon. Bull. Dep. Agric. Calif.* **23** (1934) no. 12 pp. 396–418. Sacramento, Calif. [1935.]

In California, several years of low rainfall and lack of control measures due to economic conditions, together with the extremely mild winter of 1933–34, resulted in general outbreaks of grasshoppers in 17 counties in 1934. The dominant species on range lands were *Camnula pellucida*, Scudd., and *Oedaleonotus enigma*, Scudd., and in two counties, the lesser migratory grasshopper [*Melanoplus mexicanus*, Sauss.]. In one county, *Hippiscus californicus*, Scudd., was prevalent on cereals, and *Melanoplus differentialis*, Thomas, and *Schistocerca venusta*, Scudd., on cotton. *Melanoplus femur-rubrum*, DeG., *M. marginatus*, Scudd., *M. packardi*, Scudd., and *M. devastator*, Scudd., were locally destructive in the San Joaquin and Sacramento valleys. Many crops were saved by the timely use of poison bait.

A new centre of infestation by the obscure scale [*Chrysomphalus obscurus*, Comst.], believed to be of 10 years' standing, was found in San Diego county, where it has spread to 3 other localities. About 90 orchard trees and 1,000 nursery trees were involved. No living scales were found in the original area of infestation [*R.A.E.*, A **22** 533]. In Los Angeles county *Coccus elongatus*, Sign., was present on carob trees [*Ceratonia siliqua*] planted for shade, and *Parlatoria pergandei*, Comst., on *Citrus*. Experiments were carried out in Nevada to find a treatment against insects infesting *Citrus* fruits in order to prevent their introduction on fruit imported into California from Florida. Florida grapefruits heavily infested with *Lepidosaphes beckii*, Newm., *Chrysomphalus* (*Aonidiella*) *ficus*, Ashm. (*aonidum*, auct.) and *L. gloveri*, Pack., were treated with 12 formulae, of which the 9 that gave complete mortality contained a medium oil with a viscosity of about 70 secs. Saybolt and an unsulphonated residue of over 90 per cent. Oranges and lemons from California infested with *L. beckii*, *L. gloveri* and *Aonidiella* (*C.*) *aurantii*, Mask., were treated with equal success. In tests with 6 varieties of avocado infested with latania scale [*Aspidiotus lataniae*, Sign.], all the scales were killed by immersion for 3 minutes in a dip (3 per cent.) of an emulsion containing 82 per cent. oil to which 1 lb. liquid coconut oil soap per 100 U.S. gals. water had been added. When the wrappings covering the soil and roots of nursery

stock were soaked in a saturated solution of naphthalene in petrol, the petrol evaporated and left the naphthalene, which repelled earwigs [*Forficula auricularia*, L.] for 7 days, whereas untreated stock was invaded in 24 hours. *Forficula* is resistant to many contact insecticides in concentrations lethal to most insects. Hydrocyanic acid gas applied to the soil and roots in gas-tight bags gave considerable success, and when the roots were buried 2 ins. deep, a heavy dosage for 15 hours killed all the earwigs. This gas, however, kills some ornamental plants. In fumigation tests against the grain weevil [*Calandra granaria*, L.], hydrocyanic acid gas, chloropicrin and a mixture of ethylene dichloride and carbon tetrachloride used at atmospheric pressure under gas-tight tarpaulins destroyed 95–100 per cent. of the weevils in grain.

Against San José scale [*Aspidiotus perniciosus*, Comst.] and European red mite [*Paratetranychus pilosus*, C. & F.] on pear, oil sprays at stengths of less than 4 per cent. allowed too many individuals to survive, and even at this concentration many eggs of the mite were not destroyed. Nicotine dusts (4 per cent.) applied from aeroplanes were successful against the bean thrips [*Hercothrips fasciatus*, Perg.] under conditions where ground equipment could not be used. A new area of infestation by the vegetable weevil, *Listroderes costirostris*, Schönh. (*obliquus*, Gyll.), spreading into 4 counties has been found which has probably been established for some years.

Miscellaneous pests recorded during the year included : *Lepidosaphes halli*, Green [*cf.* **12** 196] on stone-fruit trees, and *Cicadula maidis*, De Long & Wolcott, on maize, both these insects being new to the United States ; *Aspidiotus forbesi*, Johns., which was taken for the first time in the State on pear ; *Xylomyges curialis*, Grote, which attacked the blossoms and fruits of *Citrus* and caused a loss to growers of over £5,000 ; *Pseudaonidia duplex*, Ckll., on fig ; *Tortrix* (*Clepsis*) *busckana*, Keifer, attacking cyclamens in greenhouses ; *Diabrotica balteata*, Lec. (belted cucumber beetle), which is becoming more common and almost as important as *D. soror*, Lec., in southern California, and is advancing steadily northwards ; and *Laphygma frugiperda*, S. & A., which severely damaged maize in several localities during a second invasion which took place in 1934 but did not extend as far north as in 1931. These invasions are probably due to the cultivation of large areas that were formerly desert and made a natural barrier between Mexico and California.

Fleury (A. C.). **Bureau of Plant Quarantine.**—*Mon. Bull. Dep. Agric. Calif.* **23** (1934) no. 12 pp. 483–500. Sacramento, Calif. [1935.]

In addition to some of those mentioned in previous reports [*cf. R.A.E.*, A **20** 586 ; **21** 517 ; **22** 533], the pests intercepted in California during 1934 included : *Dacus* (*Bactrocera*) *cucurbitae*, Coq., in tomatos, *Calotermes* (*Cryptotermes*) *piceatus*, Snyder, in a bamboo container for candles, and *Pulvinaria* (*Protopulvinaria*) *pyriformis*, Ckll., on *Gardenia*, from Hawaii ; *Pyrausta nubilalis*, Hb., in green maize from New York ; *Aleuroplatus samoanus*, Laing, on lime cuttings from the Society Islands ; *Anastrepha distans*, Hend., and *A. obliqua*, Macq., in the holds of vessels from Central America ; *Anomala* sp. in soil, and *Dialeurodes citri*, R. & H., on *Citrus* leaves, from Japan ; *Argyresthia conjugella*, Zell., in apples from Denmark ; *Cylas formicarius*, F., in the pseudobulbs of an orchid, and *Macrotermes gilvus*, Hag., in rubber

tree seed, from the Philippines ; *Eriococcus* sp. on cactus and succulent plants from Mexico and Japan ; *Cydia* (*Laspeyresia*) sp. and *Curculio* sp. in hazel nuts from Portugal ; *Prays citri*, Mill., from the Philippines, and *Parlatoria cinerea*, Doane & Hadden, from Mexico and Panama, both on fruits of *Citrus* ; *Platyedra* (*Pectinophora*) *gossypiella*, Saund., in cottonseed from the Orient ; and *Phyllotreta atra*, F., and *P. nemorum*, L., on rose plants from Czechoslovakia.

Gilliatt (F. C.). **Some Predators of the European Red Mite,** *Paratetranychus pilosus* **C. & F., in Nova Scotia.**—*Canad. J. Res.* (D) **13** no. 2 pp. 19–38, 1 pl., 1 ref. Ottawa, August 1935.

A study of the factors affecting the natural control of *Paratetranychus pilosus*, C. & F., on apple in Nova Scotia in the summer of 1932 showed that predators are the most important. No parasites were found. Notes are given on the bionomics and activities of the following predators : the mite, *Seiulus pomi*, Parr., the Capsids, *Daphnidia pellucida*, Uhl., *D. capitata*, Van D., and *Hyaliodes vitripennis*, Say, and the Coccinellid, *Stethorus punctum*, Lec. The investigation was based on observations in the orchard and large field cages, as the difficulty of rearing the predators under controlled conditions rendered such work impracticable. Although no one species is likely to control *P. pilosus*, the combined effect of two or more is very pronounced. Large numbers of predators are destroyed by orchard sprays. All the Capsids are killed by nicotine, and *S. pomi* by oils and some fungicides. *P. pilosus* was most abundant in areas treated with Bordeaux mixture, which is known to reduce the numbers of *S. pomi*. In tests of standard sprays in 1931, lime-sulphur was more effective in keeping *P. pilosus* in check when used alone than when combined with aluminium sulphate or iron sulphate. The smallest number of winter eggs was found on unsprayed trees, but although predators were more active here than on the treated plots, this was mainly due to scabby foliage which is unfavourable to *P. pilosus*. Bordeaux mixture definitely promoted the increase of *P. pilosus*.

S. pomi, which appears to have 3 generations a year, is probably the most important predator. It attacks all stages of *P. pilosus*, though eggs probably represent the largest proportion of the total consumed. The adults, which hibernate in concealment on the twigs, are active at rather cool temperatures and destroy the winter eggs of *P. pilosus* in autumn and spring. In 1932 the first eggs were laid in the first week in May and the last on 12th September. The incubation period lasted 7–10 days, and each female laid 6–12 eggs. The average daily consumption by an adult was found to be 1·91 mites. In tests of sprays, nicotine had no effect on *S. pomi*, but lime-sulphur was the only other spray tested that did not completely destroy it at the end of 48 hours. Some of the mites, however, would be sheltered when oils are applied in the dormant season and so escape them.

The Capsids feed on all stages of *P. pilosus* in both nymphal and adult stages. *D. pellucida*, which hibernates in the egg stage, was active from mid-June till mid-September. The nymphal period lasts 3 weeks. It is well distributed and often effects considerable reduction of *P. pilosus*. *D. capitata* has a similar seasonal occurrence, but is less numerous. *H. vitripennis*, which is one of the common predators of *P. pilosus*, has one generation a year. During the 5–6 weeks during

which it is active (from late June to early August), many infestations were effectually held in check by this Capsid in 1932.

The larvae of *S. punctum* were observed on 21st July 1932, and the first adults a week later. Eggs and young mites were the chief forms consumed by the slowly moving larvae. From one to three were present on many leaves in a number of orchards where the number of *P. pilosus* were materially reduced in a comparatively short time.

Adults of the Capsid, *Plagiognathus obscurus*, Uhl., were observed late in July and early in August 1932, attacking Aphids and all stages of *P. pilosus*. As the genus *Plagiognathus* is normally phytophagous and is thought not to breed on apple, the predacious habit is probably unusual. Nymphs of another Capsid, *Camptobrochis nebulosus*, Uhl., were first observed feeding on *P. pilosus* when in the last instar on 29th July and adults began to appear on 2nd August. It was not present in sufficient numbers to have any appreciable effect on the mite.

Minor predators included the mite, *Anystis agilis*, Banks, which was most observed in June and July and seemed to be sufficiently numerous to have a general effect except where spraying had been done ; a thrips, probably *Haplothrips* sp., the fully grown larva of which is described and which preyed upon both *P. pilosus* and *S. pomi* ; a Syrphid larva that occasionally destroyed a quiescent young mite ; and *Campylomma verbasci*, H.-S., which was very numerous in a few orchards in 1931, though only the adults were seen to attack the adult mites. This Capsid has two generations a year in Nova Scotia, and the first brood adults migrate to potato plants, where they feed for some time before returning to apple, of which they frequent the terminal growth, especially on trees infested with Aphids.

Chopard (L.). **Une idée nouvelle sur le polymorphisme specifique : les phases chez les insectes orthoptères.**—*Rev. franç. Ent.* **2** fasc. 2 pp. 57–61. Paris, 1935.

The literature on phases in locusts is reviewed. The author suggests that this phenomenon also occurs in Tettigoniids, and instances outbreaks of *Barbitistes* sp. in Var and of *Orphania denticauda*, Charp., in Haute-Loire, when the insects, which occurred in great numbers, were more darkly pigmented than usual.

Jourdan (M. L.). *Clytiomyia helluo* **F. parasite d'***Eurygaster austriaca* **Schr. (Dipt. Tachinidae).**—*Rev. franç. Ent.* **2** fasc. 2 pp. 83–85. Paris, 1935.

The Tachinid, *Clytiomyia helluo*, F., is one of the principal parasites of *Eurygaster austriaca*, Schr., which damaged wheat in Morocco in 1934. It pupates in the soil and passes the winter in the pupal stage. In 1934 the first adults emerged about 10th April. They pair, oviposit and die within a few days. The first generation develops when the temperature is comparatively low ; the egg and larval stages together last 30–32 days and the pupal about 12. Three pairs of adults of this generation that had emerged between 24th and 28th May were then placed with 5 *Eurygaster* adults ; they mated that day and were dead by 30th May. A second generation pupa appeared on 19th June, and the adult emerged on 26th. The third generation was not observed. During the summer succeeding generations occur

roughly each month; there may be five or six generations before hibernation, or two generations to one of the host. The hosts are weakened by the presence of the parasite and do not live long after it emerges.

Raucourt (M.), Trouvelot (B.) & Cabane (E.). **Importance et persistance des dépots d'arsenic dans les traitements insecticides de prés-vergers.**—*Rev. Path. vég.* **22** pp. 67–78, 2 figs., 2 refs. Paris, 1935.

Experiments were carried out in France in June 1933 to estimate the arsenic residue on fruit and leaves of apple and on grass [*cf. R.A.E.*, A **21** 398] in a meadow orchard after spraying against various Lepidoptera. Two sprays were used on different trees: A contained 10 lb. lead arsenate paste (9·8 per cent. As) per 100 gals. water, and B 2 lb. sodium arsenate (21·2 per cent. As) and 5 gals. lime-sulphur (18°Bé.) per 100 gals. The trees were sprayed from the windward side only. On the day of treatment the arsenic (As) deposit per sq. yd. on the grass was 0·00264 oz. for A and 0·000737 oz. for B, but after a rainfall of 0·86 ins. over 15 days, diminished by 37 and 58 per cent. respectively. The arsenic residue on leaves and fruits was greater on the side from which the trees were sprayed (100 : 11 for A and 100 : 17 for B). The diminution of the arsenic deposit with time was greater in the case of A than B. After 15 days, the deposit on the fruit was reduced at least to 0·028 gr. per lb. This was sufficient protection and by harvest time would be below the tolerance.

Weigert (J.) & Weizel (H.). **Beobachtungen über das Auftreten von Getreideschädlingen unter dem Einfluss verschiedener Anbaumassnahmen im Jahre 1935.** [Observations on the Occurrence of Wheat Pests under the Influence of various cultural Measures in 1935.]—*Prakt. Bl. Pflanzenb.* **13** no. 5 pp. 133–146, 3 figs. Freising, August 1935.

In 1935 *Chlorops taeniopus*, Mg., was unusually abundant on winter and summer wheat at the Nederling experimental farm, Bavaria, as it was favoured by the slow development of the ears. The females preferred backward plants for oviposition, and the percentage of infestation was 4·5 in early varieties of summer wheat and 59 in late ones. Manuring, which accelerated growth, reduced infestation considerably. *Cephus pygmaeus*, L., was fairly abundant and showed a slight preference for early sown wheat.

Ripper (W.). **Die Bekämpfung des Rübenerdflohes.** [The Control of the Beet Flea-beetle.]—*Landeskultur* no. 8 reprint 5 pp., 4 figs. [? Vienna] 1935.

Of the flea-beetles found in beet fields in Austria only *Chaetocnema tibialis*, Ill., is a pest, as *C. concinna*, Marsh., is comparatively scarce, and *Phyllotreta atra*, F., *P. nigripes*, F., and *P. vittula*, Redt., feed chiefly on weeds. Characters by which *C. tibialis* can be identified are described and figured. When the first punctures appear the intensity of the coming infestation can be gauged by sweeping the plants, control being necessary if on a sunny day at noon more than 30 of *C. tibialis* are caught per minute when using the net at normal

speed. In experiments on its control, stomach poisons and nicotine sprays and dusts proved unsatisfactory, but a dust containing 10 per cent. of ground derris root (with a 6 per cent. content of rotenone and allied substances) produced 100 per cent. mortality when used at the rate of 1 lb. per acre at temperatures of 10–28°C. [50–82·4°F.] even in a strong wind. This result was obtained either with a motor duster having a trailing apron 82 ft. long or a horse-drawn duster with a 20 ft. apron.

Speyer (W.). **Die an der Niderelbe in Obstbaum-Fanggürteln überwinternden Insekten. V. Mitteilung. Coleoptera : Rest und Nachträge einschl. Larven.** [Insects hibernating in Fruit-tree Trap-bands in the Lower Elbe Districts. Fifth Communication.] —*Z. PflKrankh.* **45** no. 9–10 pp. 433–462, 34 refs. Stuttgart, 1935.

This paper records the Coleoptera of families other than those dealt with in previous ones of the series [*R.A.E.*, A **21** 581 ; **22** 493 ; **23** 84], with brief notes on them, and also includes an annotated list of the Coleopterous larvae found in the bands, and tables showing the numbers of the various species of Coleoptera collected by Lundblad in Sweden and in each year from 1926 to 1932 in the Lower Elbe districts. In the latter *Anthonomus pomorum*, L., represented 17,286 out of a total of 17,485 individuals of Bruchids, Anthribids and Curculionids, while in Sweden it represented 114 out of 127.

Abraham (R.). **Wanzen (Heteroptera) an Obstbäumen. III. Mitteilung. Die anatomische Untersuchung geschädigter Früchte.** [Bugs on Fruit Trees. Third Communication. The Anatomical Examination of injured Fruits.]—*Z. PflKrankh.* **45** no. 9–10 pp. 463–474, 7 figs., 20 refs. Stuttgart, 1935.

This third paper [*cf. R.A.E.*, A **22** 340, etc.] deals with the type of injury caused by the punctures of *Plesiocoris rugicollis*, Fall., and *Lygus pabulinus*, L., in apples and of *L. pabulinus* in cherries.

In nature young apples were attacked when not more than an inch in diameter, though older ones were punctured in experiments. In young apples a kind of cambium layer separates the normal tissue from the cavity so caused. This layer then produces a compensating tissue that gradually fills the cavity. In older apples the filling tissue is produced by the individual parenchyma cells growing into cell filaments. No difference was seen between the effect of punctures by *P. rugicollis* and *L. pabulinus*. The punctures of the latter on cherries have the same effect as observed in apples. There is no healing of the injuries in the tissues of cherry, but protective processes are formed, a gum being deposited in the cells surrounding the cavity.

Madle (H.). **Beobachtungen an** *Ceutorrhynchus pleurostigma* **Marsham und** *C. quadridens* **Panzer im Gemüsebaugebeit Zittau im Sommer 1934 (Kohlgallenrüssler und Kohltriebrüssler).** [Observations on *Ceuthorrhynchus pleurostigma* and *C. quadridens* in the Vegetable-growing District of Zittau in Summer 1934.]—*Z. PflKrankh.* **45** no. 9–10 pp. 478–498, 5 figs., 4 refs. Stuttgart, 1935.

The following is taken from the author's summary of observations made from April to August 1934 on *Ceuthorrhynchus pleurostigma*,

Marsh., and *C. quadridens*, Panz., attacking cauliflower in Saxony. These weevils had only one generation a year. *C. quadridens* began ovipositing in mid-April and *C. pleurostigma* early in May. Oviposition ended early in June. Larval development took 3–8 weeks, varying with the temperature. Pupation occurred in the ground at a depth of about an inch in an earthen case. The adults emerged from the second half of June onwards and at once began maturation feeding, usually on cauliflowers planted out a fortnight previously. This feeding took different forms, but the failure of cauliflowers to form a heart was not due to adult or larval feeding by these weevils.

C. quadridens oviposited in the leaf-stalks of winter cauliflowers and, especially, nursery seedlings that had been kept under too mild conditions. Hardy seedlings were only slightly attacked. A nicotine spray or one containing nicotine, cresol and soap prevented oviposition for a short time only. Infested plants should not be thrown on a compost heap as the larvae continue to develop there; they should be placed in a solution of copper sulphate. *C. pleurostigma* bred chiefly in the stems of winter cauliflower, and infestation in seedling-boxes was slight. Only one egg was laid on each plant. Growers nip the gall when planting out and thus kill the larva. Mature larvae entering the ground were very sensitive to moisture and thorough, repeated watering during and after harvest should destroy many of them. As the larvae leave the infested stems shortly after the cauliflowers have been cut, the stems should be uprooted and thrown into a solution of copper sulphate. As both species can fly well, concerted action by all growers is necessary.

Hilgendorf (G.) & Fischer (W.). **Vereinfachte Verfahren zur Analyse von Obstbaumkarbolineen und Baumspritzmitteln.** [Simplified Methods for the Analysis of various Tar Distillates.] —*NachrBl. dtsch. PflSchDienst* **15** no. 9 pp. 81–82. Berlin, September 1935.

Fruit-tree carbolineum and the tar distillate preparations called "Baumspritzmittel" have hitherto been analysed by the efficient, but lengthy, Houben process [*R.A.E.*, A **18** 183]. The details of two more rapid methods are given, the results of which agree closely with those given by the Houben and toluol methods. Baumspritzmittel contain a comparatively large amount of tar acids and a small amount of water.

Speyer (W.). **Coccinelliden als Blutlaus-Feinde.** [Coccinellids as Enemies of the Woolly Aphis.]—*NachrBl. dtsch. PflSchDienst* **15** no. 9 p. 83. Berlin, September 1935.

Observations in the Lower Elbe districts in August and September 1934 and in the early spring of 1935 showed that Coccinellids were valuable enemies of the woolly apple aphis [*Eriosoma lanigerum*, Hsm.]. The species of importance were *Exochomus quadripustulatus*, L., *Coccinella septempunctata*, L., *C. quinquepunctata*, L., *Adalia* (*C.*) *bipunctata*, L., and *Adonia variegata*, Gze. Where severe infestations by *Eriosoma* or leaf Aphids require the preservation of the Coccinellids, lime-sulphur or the so-called fruit-tree carbolineums should be used for winter spraying, and not the tar distillates of the "Baumspritzmittel" type [*cf.* preceding paper].

Ruhdolf (L.). **Schäden an Sternanis durch den rotbeinigen Kolbenkäfer.** [Injury to Star Anise by *Necrobia rufipes*, DeG.]—*Mitt. Ges. Vorratsschutz* **11** no. 5 pp. 61–62, 1 fig. Berlin, September 1935.

Larvae of *Necrobia rufipes*, DeG., were found in a Hamburg warehouse in imported fruits of star-anise [*Illicium verum*], to which they had evidently migrated in order to pupate in the seed chambers.

Liebermann (A.). **Kornkäfer oder Queckeneule ?** [*Calandra granaria* or *Hadena basilinea* ?]—*Mitt. Ges. Vorratsschutz* **11** no. 5 pp. 64–66, 1 fig. Berlin, September 1935.

The differences in the appearance of wheat grains injured by the grain weevil [*Calandra granaria*, L.] and by the Noctuid, *Trachea* (*Hadena*) *basilinea*, F., are illustrated and described in view of their having been confused in Germany. Though the Noctuid larvae are sometimes carried into barns at harvest time, they do not survive in stored grain.

Massee (A. M.), Thomas (F. J. D.) & Hey (G. L.). **The Fauna of the Weevil "Sack-band." II.**—*Ann. Mag. nat. Hist.* (10) **16** no. 93 pp. 350–354. London, September 1935.

A list is given of insects taken in sacking bands used against *Anthonomus pomorum*, L. (apple blossom weevil) in England, additional to those recorded in a previous list [*R.A.E.*, A **18** 602]. Such bands seem likely to be of value in collecting uncommon insects. They catch most insects if placed round the trunks of the trees at a height of 2–3 ft. They should be 6 ins. wide, folded once, and twice as long as the circumference of the trunk.

Miles (H. W.) & Miles (M.). **Insect Pests of Glasshouse Crops.**—Demy 8vo, 174 pp., 21 pls., 15 figs. Hook, Surbiton, Surrey, H. C. Long, 1935. Price 9*s*.

The first chapter of this book, which deals primarily with pests occurring in England, discusses conditions in glasshouses in relation to the occurrence and control of insect pests. In subsequent chapters the appearance, life-history and control of each species or group of insects and the nature of the damage caused to the plants are briefly described. Soil sterilisation, fumigation, and the nature, type and method of applying various well-known insecticides are the subjects of the final chapter. A list of the chief glasshouse crops, showing the nature of the injury caused by pests associated with them, and a bibliography are appended.

Della Beffa (G.). **Insetti osservati nella frutta e negli ortaggi dei mercati di Torino.** [Insects observed in Fruits and Vegetables in the Markets of Turin.]—*Difesa d. Piante* **12** no. 3 pp. 77–85. Turin, June 1935. [Recd. September 1935.]

This is an annotated list of the insects found in fresh fruits, dried fruits, vegetables, cereals, and other food-stuffs in the markets in Turin. Those in dried fruits were : *Plodia interpunctella*, Hb., and *Tinea granella*, L., in chestnuts ; *Ephestia afflatella*, Mann, in dates ;

E. calidella, Gn., *E. cautella*, Wlk., *E. kühniella*, Zell., *Carpophilus hemipterus*, L., *Cryptophagus pilosus*, Gyll., and *Atomaria atricapilla*, Steph., in figs; *Cydia* (*Carpocapsa*) *amplana*, Hb., and *E. kühniella* in almonds; *C. amplana* and *Curculio* (*Balaninus*) *nucum*, L., in walnuts; *C. amplana*, *C. nucum* and *Ephestia figulilella*, Gregson, in hazel nuts; and *Plodia interpunctella* and *Tinea cloacella*, Haw., in old and badly preserved dried plums, apples, etc.

[Paramonov (A. Ya.).] **Парамонов (А. Я.). Zur Frage nach der forstwirtschaftlichen Bedeutung von** *Dasychira pudibunda* **L.** [The Question of the economic Importance in Forestry of *D. pudibunda*.] [*In Ukrainian.*]—*Trav. Mus. zool. Acad. Sci. Ukr.* no. 14 pp. 81–89, 1 graph, 2 refs. Kiev, 1935. (With Summaries in Russian and German.)

Following a severe outbreak of the Lymantriid, *Dasychira pudibunda*, L., in deciduous forests in the Ukraine in 1931–32, an investigation was made in the spring of 1933 on the effect of the infestation on the development of oak. For this purpose nine oaks of different ages that had been almost or completely defoliated and one that had not been attacked were felled, and their growth since 1922 was determined by examining cross sections from the trunks. The results of the analysis are shown in tables. By comparing the mean growth in normal and outbreak years, it was found that complete defoliation has no apparent effect on the growth of the trunk either in the year of the infestation or in the following one. The only loss of wood is in branches and twigs in the upper part of the crown in the year following infestation, and it does not exceed 8·4 per cent. of the general increase in wood of the tree. This is probably due to the fact that the chief damage is done in the second half of the summer when the increase in growth has already taken place.

The outbreak was brought to an end in 1933 by unusually abundant rainfall throughout the summer.

Bongini (V.). **Azione insetticida degli olii minerali.** [The insecticidal Action of Mineral Oils.]—*Difesa d. Piante* **12** no. 4 pp. 139–142. Turin, August 1935.

Tests with a mineral oil specially prepared for the winter spraying of deciduous trees and used at a concentration of 4 per cent. were made in North Italy in late February and early March at temperatures always above 5°C. [41°F.].

Infestation of pear by *Eriophyes* (*Phytoptus*) *pyri*, Pgst., was reduced by about 85 per cent. On pear and plum infested by *Epidiaspis* (*Diaspis*) *leperii*, Sign., the mortality was 60–85 per cent. as against a maximum of 25 per cent. on unsprayed trees. On peach and gooseberry *Aulacaspis* (*Diaspis*) *pentagona*, Targ., had a mortality of 75 per cent. as compared with 20 per cent. on untreated plants.

When the insecticide was brushed on, so as to penetrate every crack in the bark, peach trees heavily infested with *A. pentagona* were entirely freed from it. Brushing the roots of apple infested by *Eriosoma lanigerum*, Hsm., was equally effective, and on pear the mortality of *E. leperii* was 85–90 per cent. The foliage of *Euonymus japonicus* was not injured by the spraying, and infestation by *Chionaspis euonymi*, Comst., was reduced.

Morris (H. M.). **Annual Report of the Entomologist for 1934.**—*Rep. Dep. Agric. Cyprus 1934* pp. 39–44. Nicosia, 1935.

Lepidosaphes beckii, Newm., was found on *Citrus* in Cyprus in June 1934. As it was well established but only occurred in a small area, it had probably been present a number of years and been introduced from abroad. All *Citrus* trees in the area are being fumigated. Fumigation was also used against *Aonidiella* (*Chrysomphalus*) *aurantii*, Mask., and sprays of white oil emulsion against this scale and to a less extent against *Coccus* (*Lecanium*) *hesperidum*, L., though this is usually sufficiently controlled by *Coccophagus* spp. *Icerya purchasi*, Mask., and *Ceroplastes floridensis*, Comst., which do not occur in Cyprus, were intercepted on *Citrus* seedlings from Palestine. A considerable reduction in the amount of *Citrus* fruit damaged by *Ceratitis capitata*, Wied., was effected applying bait-sprays of 1 lb. sodium fluosilicate, 24 lb. granulated sugar and 40 gals. water at intervals of about 8 days from early September until mid-December.

Dociostaurus maroccanus, Thnbg., was much less numerous than it had been even in 1933 [*cf. R.A.E.*, A **23** 14] and *Tettigonia viridissima*, L., and *Calliptamus italicus*, L., were not abundant. Other pests not mentioned in the preceding year's report [*loc. cit.*] included: *Aphis rumicis*, L., on broad beans; *A. gossypii*, Glov., on melons and cucumbers; the Tenebrionids, *Apentanodes globosus*, Reiche, *Opatroides punctulatus*, Brullé, and *Zophosis punctata*, Brullé, on young tobacco; *Phloeotribus scarabaeoides*, Bern. (*oleae*, F.), which was more abundant on olives than usual; and *Hylotrupes bajulus*, L., which caused damage to woodwork in buildings.

Squire (F. A.). **Recent Entomological Investigations.**—*Agric. J. Brit. Guiana* **6** no. 2–3 pp. 84–90, 2 graphs, 3 refs. Georgetown, 1935.

In the first part of this paper an account is given of experiments showing that the hardness of rice varies inversely with the relative humidity. They were made in connection with an investigation on the relation between these factors and the development of *Calandra oryzae*, L. [*cf. R.A.E.*, A **22** 136]. The second part consists of a list of 106 insects which have not previously been recorded from British Guiana.

Matsumoto (F.). **On the Life History of *Ischnodemus saccharivorus* Okajima injurious to Sugar Cane in Formosa (Lygaeidae, Heteroptera), (1).** [*In Japanese.*]—*Trans. nat. Hist. Soc. Formosa* **25** no. 144 pp. 314–319, 1 graph. Taihoku, September 1935.

The Lygaeid, *Ischnodemus saccharivorus*, Okajima, which sometimes causes serious damage to sugar-cane in Formosa, usually has three overlapping generations a year. The winter is passed mainly in the adult stage, but pairing and oviposition continue even in the coldest season, January and February.

Otanes (F. Q.) & Butac (F. L.). **A preliminary Study of the Insect Pests of Cotton in the Philippines with Suggestions for their Control.**—*Philipp. J. Agric.* **6** no. 2 pp. 147–174, 10 pls., 26 refs. Manila, 1935.

This is a compilation of data from the literature and personal observation on insect pests of cotton in the Philippines. General

suggestions for control include the selection of resistant varieties, planting at favourable seasons and the practice of cultural methods to conserve soil moisture. The water balance of the plants is an important factor in their resistance. No single control method should be depended on.

Amorphoidea lata, Motsch., is a most injurious pest [*cf. R.A.E.*, A **11** 94]. In Manila the egg, larval and pupal stages lasted 2–3, 6–11, and 2–5 days, respectively, and the preoviposition period 1–4 days. All stages are briefly described. Control measures recommended include daily destruction of dropped bolls and of weevils congregating in newly opened flowers. A dust of equal parts of calcium arsenate and a carrier killed them in 30 minutes. Early planted cotton may be used as a trap crop. The Lygaeid, *Geocoris tricolor*, F., which is briefly described, preys on the weevils. The larvae of a species of *Cosmophila*, considered to be *C. erosa*, Hb. [but *cf.* **12** 519], feed on the leaves and cause great injury when abundant. They also occur on cowpeas and okra [*Hibiscus esculentus*]. In the laboratory the eggs hatched in 2–3 days, the larval stage lasted 2–16, and the pupal 6–7. The larvae can be controlled by dusts or sprays of calcium arsenate or, when young, by spraying with soap solution. *Euplectrus* sp., which is briefly described, parasitises the larvae, and *Trichogramma minutum*, Riley, which was introduced from the United States in 1934, attacks the eggs, and has been liberated in the field.

The Pyralid, *Sylepta derogata*, F., lays its eggs singly on the lower surface of the leaf. The larva rolls the leaf, and feeds and pupates in it. In the laboratory, the egg stage lasted 2–3 days, the larval 14–16, and the pupal 6–7. A Tortricid, *Homona* sp., which lays its eggs in masses, has also been found on cotton, and *T. minutum* has been reared from its eggs. All stages of these three moths are described.

Platyedra (*Pectinophora*) *gossypiella*, Saund., the bionomics and control of which are discussed from the literature, has only been injurious on one island in the Philippines. In the laboratory the pupal period lasted 11 days in November. An attempt will be made to use *T. minutum* as a control. Other Lepidopterous pests include *Heliothis* (*Chloridea*) *obsoleta*, F., *Earias* sp., and *Lithocolletis triarcha*, Meyr., which is parasitised by *Elasmus* sp. near *homonae*, Ferr., and *Sympiesis* sp.

The most injurious of the sucking insects are *Ferrisiana* (*Ferrisia*) *virgata*, Ckll., *Aphis gossypii*, Glov., and *Empoasca flavescens*, F. Records of numerous other food-plants of the first two are given. Both are fostered by ants, particularly *Solenopsis geminata*, F., and both are attacked by the Coccinellid, *Chilomenes sexmaculata*, F., and unidentified predators and parasites. *Geocoris tricolor* has also been observed to destroy *F. virgata*. *Empoasca flavescens*, which occurs on egg-plant [*Solanum melongena*] and potato, becomes very numerous on cotton towards the end of the rainy season and causes the leaves to curl. The eggs are deposited in the midribs of the cotton plants. Together with *A. gossypii* and *Tetranychus* sp., it was responsible for the failure of an extensive cotton planting in 1926.

Cotton is also attacked by *Dysdercus* spp., chiefly *D. cingulatus* F. (*megalopygus*, Breddin), two species of thrips that cause spotting and discolouration of the leaves, an Aleurodid of the genus *Bemisia*, which also occurs on a variety of other plants, and the Cercopid, *Machaerota ensifera*, Burm.

Lists of insects recorded from cotton in the Philippines by Woodworth [**11** 27, etc.] and in the Malay Archipelago by Dammerman [**17** 233] are appended.

PEMBERTON (C. E.). **Giant Sugar Cane Moth Borer intercepted in Honolulu.**—*Hawaii. Plant. Rec.* **39** no. 3 pp. 151–154, 3 figs., 5 refs. Honolulu, 1935.

An adult of *Castnia licus*, Dru., emerged in July 1935 from a pupa in a root stalk of *Heliconia angustifolia* that had been imported into Hawaii from the Panama Canal Zone and had been kept under observation after being fumigated. The importance of this moth as a pest of sugar-cane in Trinidad and other parts of tropical America is briefly discussed from the literature [*cf. R.A.E.*, A **18** 250].

BIANCHI (F. A.). **Two interesting Pests of Sugar Cane in Guatemala, *Podischnus agenor* Burmeister and *Scaptocoris talpa* Champion.**—*Hawaii. Plant. Rec.* **39** no. 3 pp. 191–197, 3 figs. Honolulu, 1935.

Sugar-cane in Guatemala is attacked by the Dynastid, *Podischnus agenor*, Burm., and the Cydnid, *Scaptocoris talpa*, Champ. Except in one area *P. agenor* seems to be unknown as a pest of cane, though its range extends from British Honduras to the Upper Amazon and is wider than that of *P. tersander*, Burm., the only other member of the genus. Characters distinguishing the adults of these two species are briefly indicated. *S. talpa* has only been found on the west coast of Guatemala.

The larva of *P. agenor* prefers uncultivated areas and has been found near rotten stumps deeply buried in the soil. It is rare near the surface except at the beginning of the dry season, in October and November. The larval stage probably lasts at least 2 years. One larva collected in the last instar on 24th November 1932 did not pupate until 14th May 1934, after a prepupal stage of about 2 weeks. In the laboratory the larvae much preferred potatoes to cane rhizomes. They can survive long periods without food. The adult beetles of both sexes bore into the stalks of sugar-cane, usually entering one of the root bands in the upper half of the stalk and destroying the contents of about two internodes. Probably the beetles emerge only once from the stalk; they then pair, bury themselves in the soil and oviposit. About 30,000 were collected in two weeks by tapping the stalks to drive them out. The beetles lived several months in captivity when fed on sugar-cane. As the last appearance in numbers of *P. agenor* had occurred 6–7 years before the present one, it is thought to be well controlled by natural enemies, of which an unidentified species of *Campsomeris* is probably one. *S. talpa* was abundant only in two sharply defined areas. On 31st January 1934 from 12 to over 200 individuals of all stages but the egg were found per stool. The stools showed no sign of disease or rot except that few of the buds had germinated. In August the population remained unchanged but in October, after the field had lain fallow for two months, it was smaller and almost entirely the adult stage. A predacious Elaterid larva had increased in numbers and seemed likely to effect eventual control. In the laboratory these larvae survived long periods of starvation, and preferred *S. talpa* to other food, including *Lachnosterna*.

Adults of both sexes of *S. talpa* possess wings, though they were never observed to fly and were seen only in the soil. They lived several weeks in the laboratory in jars of soil with sections of cane and preferred to puncture roots put forth by this cane, but also pierced the rind into the softer zone of adventitious roots or fed directly on the cut surface of the cane.

ALVARADO (J. A.). **Nuestros insectos auxiliares. León de los pulgones.** [Our Insect Auxiliaries. *Chrysopa perla.*]—*Rev. agríc. Guatemala* **13** no. 4 pp. 227–230, 1 fig. Guatemala, 30th June 1935. [Recd. September 1935.]

Chrysopa perla, L., is recorded as attacking Coccids of the genus *Pseudococcus* (including *P. citri*, Risso) on coffee in Guatemala. It was not, however, very plentiful.

SWABEY (C.). **Notes on Insect Attack on Mora** (*Mora excelsa* **Benth.**) **in Trinidad.**—*Leafl. For. Dep. Trin. Tob.* no. 6, 39 pp., 10 figs., 10 refs. Trinidad, 1935. Price 6*d.*

Brief notes are given on the principal insects attacking timber of *Mora excelsa* in Trinidad, which comprise: the Scolytids, *Xyleborus* spp., *Pterocyclon* sp., and *Phloeoborus rugatus*, Bldfd., and the Platypodid, *Tesserocerus dejeani*, Chap., in the sapwood of recently felled logs; the Bostrychid, *Xylopsocus capucinus*, F., the Cerambycid, *Megaderus stigma*, L., and the Lymexylonid, *Atractocerus brasiliensis*, Lep. & Serv., in the sapwood of stacked timber; the Platypodids, *Platypus alternans*, Chap., and *P. ratzeburgi*, Chap., and the Cerambycids, *Trachyderes succinctus*, L. (*cayennensis*, Dupont) and *Neoclytus rufus*, Ol., in both felled and stacked timber; the Bostrychid, *Tetrapriocera tridens*, F., in seasoned sapwood; the Lyctid, *Minthea squamigera*, Pasc., in seasoned or partly seasoned sapwood; the Curculionid, *Metamasius hemipterus*, L., which is found very occasionally in the sapwood; and the larvae of Buprestids, in the cambium of old felled logs. Predators observed were the Clerid, *Tarsostenus univittatus*, Rossi, a Histerid, *Trypanaeus* sp., which is probably new, and ants. The characters distinguishing the type of damage done by pinhole borers (Scolytids and Platypodids) and powder-post beetles (Lyctids) are given.

A number of experiments on control were carried out in 1933 and 1934 from which the following conclusions were drawn: Removing the bark increases the damage by pinhole borers, and although "squaring" gives a decrease, this is largely due to the exposure of the heartwood, which is not usually attacked, and the sapwood is as badly attacked as in the control. Steaming green, partly seasoned and seasoned timber appeared to kill insects present in the wood, but did not prevent further attack by Bostrychids and Cerambycids. No treatment with combined steaming and spraying gave complete control, but steaming and spraying or painting with sodium arsenite appeared to be the best. Spraying and painting with a preservative or either alone were of no value; neither was immersion in water for short periods. Ring-barking the trees did not kill them within 6 months and had no effect on attack by Scolytids in the forest or by Bostrychids and Cerambycids on timber. Ring-barking followed by painting the exposed portion with sodium arsenite to poison the tree

did not materially lessen insect attack either on recently felled or on seasoned timber. There does not appear to be any definite periodicity of attack nor any correlation between it and atmospheric humidity. Although the relative humidity range is twice as great at the top of a timber stack, this did not appear to effect the incidence of attack. Felling isolated trees over 1 mile from the normal felling area did not prevent damage, and the segregation of stacks and rapid seasoning of the wood were not effective alone. Control measures are complicated by the fact that a treatment inimical to Scolytids may be beneficial to Bostrychids. Rapid seasoning followed by storing the felled logs in water, or water storage alone, and kiln sterilisation accompanied by seasoning, the temperature and humidity being regulated to obtain a temperature that kills the insects without damaging the timber, are advised. Infested material should be segregated and the finished product removed from the infested area. The elimination of sapwood from high grade material is the only safe way to prevent attack.

SMART (J.). **The Effects of Temperature and Humidity on the Cheese Skipper,** *Piophila casei* **(L.).**—*J. exp. Biol.* **12** no. 4 pp. 384–388, 1 fig., 8 refs. London, October 1935.

The results are given of experiments to determine the thermal death point at controlled relative humidities of the larva and pupa of *Piophila casei*, L. The method of breeding the flies and the apparatus used in the experiments are described. The larvae could withstand temperatures as high as 52°C. [125·6°F.] for 1 hour and 45°C. [113°F.] for 24. The thermal death point for 1 hour's exposure, irrespective of humidity, was 52·5°C. [126·5°F.]. The optimum humidity for survival of larvae at high temperatures was about 60 per cent. The pupal stage lasted 8 days at 25°C. [77°F.], independent of humidity, and 6 days at both 30°C. [86°F.] and 35°C. [95°F.]. Regardless of humidity, the percentages of pupae that produced adults were 100 at 35°C., 50 at 36°C. [96·8°F.] and 0 at 37°C. [98·6°F.], allowance being made for the natural death rate among pupae at lower temperatures (1–3 per cent.). The failure of flies to emerge was not due solely to the direct action of temperature but partly to some secondary, physiological effect of temperature.

TUCKER (R. W. E.). **Report on Entomological Section for Year ending March 31st, 1935** [Dep. Sci. Agric. Barbados].—*Agric. J. Barbados* **4** no. 2 pp. 62–65. Barbados, April 1935. [Recd. October 1935.]

The colonisation of *Trichogramma minutum*, Riley, for the control of *Diatraea saccharalis*, F., on sugar-cane in Barbados [*cf. R.A.E.*, A **22** 699, etc.] was continued in 1934–35. Large numbers of *Sitotroga* [*cerealella*, Ol.] in the breeding cages were parasitised by *Habrocytus cerealellae*, Ashm., so that fewer individuals of *Trichogramma* were reared and liberated. Its efficiency in the field was also limited by prolonged dry weather, but in spite of this, the liberations were beneficial. Following its importation from Antigua [**23** 421], *Lixophaga diatraeae*, Tns., was reared and released in numbers, and a stock was maintained in the laboratory. *Paratheresia claripalpis*, Wulp, was introduced from Trinidad during May and June 1934, but breeding in the laboratory was not successful, and only very small numbers were liberated.

During the year 3,670 larvae of the predacious Elaterid, *Pyrophorus luminosus*, Ill., were imported from Porto Rico against *Lachnosterna smithi*, Arr. [*cf.* **22** 699]. It was difficult to find cane-fields that contained sufficient larvae of *Lachnosterna* in the wetter, hillier area suitable to *Pyrophorus*, but eventually all the larvae were liberated close to an adequate food supply. A Cecidomyiid, probably *Contarinia lycopersici*, Felt, caused considerable damage to tomatos; the flowers were shed prematurely, and the fruit that had set was deformed. There was an increase in tomato erinose, probably due to the presence of *Eriophyes cladophthirus*, Nal.

A serious Pest new to Bermuda.—*Agric. Bull. Bermuda* **14** no. 7 pp. 54–55. Hamilton, July 1935.

A leaf from a grape vine sent in June 1935 to the Department of Agriculture proved to be attacked by *Phylloxera vitifoliae*, Fitch (*vastatrix*, Planch.), which has not previously been recorded in Bermuda.

Controlling the Fruit-fly.—*Agric. Bull. Bermuda* **14** nos. 8–9 pp. 62–64, 69–70. Hamilton, August–September 1935.

The Mediterranean fruit-fly [*Ceratitis capitata*, Wied.] seriously damages fruit, especially peaches, in Bermuda. An outline is given of its bionomics; the life-cycle lasts 3 weeks in summer and about 3 months in winter, and the adult females, if given suitable food and water, may live for 10 weeks, and lay as many as 600 eggs. The parasite, *Opius humilis*, Silv., which was introduced between 1926 and 1928 [*cf. R.A.E.*, A **16** 229], is now established, but is not a materially effective control. Susceptible fruits should be picked early and ripened indoors; in Bermuda oranges and grapefruits are rarely attacked until they are nearly ripe. Other measures recommended include the destruction of infested fruit, covering valuable fruits with bags or whole trees with mosquito netting, and the use of baits and bait-sprays. In an experiment, two tins containing a bait of bran and borax (1 oz. of each to 1 pint water) with a trace of sodium arsenite [*cf.* **21** 301] and hung on a peach tree caught 96 females and 44 males in a few days.

Reed (W. D.), Morrill jr. (A. W.) & Livingstone (E. M.). **Trapping Experiments for the Control of the Cigarette Beetle.**—*Circ. U.S. Dep. Agric* no. 356, 13 pp., 9 figs., 2 refs. Washington, D.C., June 1935.

Further experiments were made in Virginia on the control of *Lasioderma serricorne*, F., in tobacco storage warehouses by suction light traps [*cf. R.A.E.*, A **22** 641]. In two open warehouses one trap was used to every 110,500 cu. ft. from June to October. The beetles caught were estimated at intervals. The figures showed a peak between 7th and 21st August in the warehouse storing domestic tobacco (156,013 per trap in 14 days) and between 18th August and 1st September in that storing Turkish (270,170 per trap in 14 days). In two other open warehouses, where infestation was higher, one trap was used for every 75,850 cu. ft. from June to November. The figures showed a peak from 24th July to 14th August in the one containing local tobacco

(112,750 per trap in 21 days) and in the one containing Turkish from 21st to 28th September (884,000 per trap in 7 days). In a closed warehouse storing Turkish tobacco one trap was used to about 80,000 cu. ft. from June to mid-July and to about 50,000 cu. ft. from mid-July to October. The figures showed a peak from 7th to 9th September (541,069 per trap in 2 days) and a smaller one from 9th to 23rd June (90,136 per trap in 14 days). Below 60°F. the beetles were inactive. A comparison in various seasons of the numbers trapped and the temperatures showed that temperature is not the only factor controlling migration. The smallness of the catches in spring and the rapid increase of the numbers caught during August and September indicated that the second and third brood migrate to a greater extent than the spring brood. In 1932, 36·6 per cent. of the beetles were males, and in 1933, 43·6.

The traps proved ineffective against *Ephestia elutella*, Hb.

Entomology and Limnology.—*Rep. Cornell agric. Exp. Sta.* **47** (1934) pp. 85–94. Ithaca, N.Y., 1935.

In experiments by G. W. Herrick and G. H. Griswold a mixture of ethylene dichloride and carbon tetrachloride with paradichlorobenzene was very effective against the larvae of clothes moths. In centrally heated houses the case-making clothes moth [*Tinea pellionella*, L.] lays eggs throughout the year. Experiments showed that it may complete 2 generations in a year. Herrick and F. R. Shaw state that exposing gladiolus corms to a temperature of 37°F. for 2 weeks destroys adults of the gladiolus thrips [*Taeniothrips simplex*, Morison] and does not injure the corms. An exposure of 2 months will apparently free the corms entirely from infestation. Treatment with formalin is not effective unless the corms are immersed for more than 10 minutes.

G. F. MacLeod reports that an outbreak of the tarnished plant bug [*Lygus pratensis*, L.] occurred on celery during the year. Fields treated with dusts of sulphur and lime showed few or no insects, while in untreated fields 50–90 per cent. of the plants were severely injured. Injury to potato tubers by millepedes and scab-gnats [*Sciara*] is most commonly dependent on the presence of primary injury. Preliminary studies in which sulphuric acid was used to alter the hydrogen-ion concentration of the soil showed some promise. Applying sulphur, naphthalene and tobacco to the soil gave widely divergent results. Of 4 species of wireworms found in potato fields, the wheat wireworm [*Agriotes mancus*, Say] was the most destructive. Eggs were deposited in sod fields only and not in grain or potato crops. Removing the sod from potato land for 3 consecutive years reduced the percentage of infested tubers from 98 to less than 1. Fertile beetles cannot live in situations where the relative humidity is less than 25 per cent., and newly-hatched larvae cannot live in soil with a moisture content of less than 7·5 per cent. The moisture content of infested soil was 2 or 3 times greater throughout the season than that of uninfested soil in the same field. Combinations of lead arsenate and Bordeaux mixture gave the best control of leafhoppers [*Empoasca fabae*, Harr.], which are the most important pest of potatoes on muck land. Although injury to the vines by flea-beetles [*Epitrix cucumeris*, Harr.] was reduced by a spray of calcium arsenate and Bordeaux mixture, no corresponding reduction of larval injury to tubers was observed.

The increased yields obtained from spraying are due largely to the increased number of marketable potatoes, 40 per cent. of the increase being due to the larger number of first-grade potatoes, and 16 per cent. to increase in size. Five or six applications of Bordeaux mixture (4 : 4 : 50) or its equivalent in dust form gave satisfactory control of insect pests, and the yield increased from 40 to more than 130 bushels per acre. On Long Island, cutworms seriously damaged many tubers in one locality. Although leafhoppers and Aphids were numerous for a short time, the yields were not reduced. There was only one generation of *E. cucumeris*, principally on potatoes, in the experimental area. The natural mortality of young larvae of the Colorado potato beetle [*Leptinotarsa decemlineata*, Say], which was the most serious pest, amounted to 55 per cent. 24 hours after hatching. The peak of egg deposition occurred on 7th June. Plots receiving 4 applications of 8 lb. calcium arsenate in 100 U.S. gals. Bordeaux mixture yielded 35 bushels per acre more than those receiving only one.

The onion thrips [*Thrips tabaci*, Lind.] reduced the yield of onions by 40 per cent. in 1933. The plants attacked produce bulbs that soften and sprout in storage. Wind is the major factor in the spread of this thrips. Crude chipped naphthalene continued to give good control and is more effective when scattered on the onion rows than when broadcast. From 3–4 applications of a mixture of 40 lb. naphthalene and hydrated lime, which is a very effective repellent against the thrips, increased the yield by 100–150 bushels per acre. In experiments on the resistance of varieties of plants to insect attack, lima beans suffered little or no injury from the Mexican bean beetle [*Epilachna corrupta*, Muls.] and 39 other varieties of beans differed in the degree of susceptibility. Studies on the effects of temperature and humidity on the size and rate of development of the bean "weevil" [*Bruchus obtectus*, Say], the confused flour beetle [*Tribolium confusum*, Duv.] and mealworms [*Tenebrio molitor*, L.] showed that humidity is the more important factor and may be expressed as a straight line function. With humidities up to 90 per cent. development is more rapid and larger insects are produced. The larger size is due to real growth and not to increased water content. When humidity and temperature are considered together, the result may be expressed as a catenary curve for larvae of the Bruchid and a Van't Hoff curve for the adults. This emphasises the value of dry storage for the control of these pests in stored products.

Ruhmann (M. H.). **Report of Provincial Entomologist.**—*Rep. Dep. Agric. Brit. Columbia 1934* **29** pp. R37–B39. Victoria, B.C., 1935.

A mealybug that has occurred for some time in orchards in the Nelson District of British Columbia has increased rapidly in the last two years and is resistant to the commonly used sprays. Apple and cherry are particularly attacked but infestation has spread to many deciduous ornamental trees. At the end of June 1934 large numbers of eggs were beginning to hatch. In an experiment on 6th August, when the young mealybugs were scattered over the lower surfaces of the foliage at the rate of about 11 to a leaf and were still unprotected by wax filaments, sprays of 1 per cent. oil emulsion, alone and in combination with $\frac{3}{4}$ pt. Deraten or nicotine sulphate per 100 gals., were applied.

On 9th August 100 per cent. of the young mealybugs had been killed by all the sprays used, but they had produced little effect on adults under loose bark. The trunk and main limbs should therefore be scraped before spraying.

Insect pests that showed an increase in 1934 in British Columbia included: *Eucosma* (*Spilonota*) *ocellana*, Schiff., *Tortrix* (*Cacoecia*) *argyrospila*, Wlk., *T.* (*C.*) *rosaceana*, Harr., *Enarmonia* (*Laspeyresia*) *prunivora*, Walsh, *Schizura concinna*, S. & A., *Datana ministra*, Drury, *Hyphantria cunea*, Drury, and *Ametastegia glabrata*, Fall., on apple; *Anarsia lineatella*, Zell., on peach; *Caliroa cerasi*, L., on cherry; *Heliothis obsoleta*, F., and *Agromyza parvicornis*, Lw., on maize, the latter infesting 80 per cent. of a crop grown for fodder; *Phytometra* (*Autographa*) *californica*, Speyer, on clovers and vegetable crops; *Malacosoma disstria*, Hb., on forest trees; *Emphytus canadensis*, Kby., on pansies and violets; *Rhynchites bicolor*, F., which was unusually numerous on wild and cultivated roses; and *Leptocoris trivittatus*, Say, on box-elder [*Acer negundo*]. *Tortrix* (*Archips*) *cerasivorana*, Fitch, which disappeared about 17 years ago, reappeared in 1934 on wild cherry.

Joessel (P. H.) & Suau (J.). **Essais de traitements contre le Carpocapse en 1934.**—*Bull. Off. agric. Midi* no. 55 pp. 260–308 3 pls., 5 refs. Marseilles, July 1935.

Investigations were carried out in 1934 on the control of *Cydia* (*Carpocapsa*) [*pomonella*, L.] on pear near Avignon [*cf. R.A.E.*, A **23** 521]. On one variety, various metallic arsenates in Burgundy mixture were applied in mid-April (calyx spray), mid-May and early June. Each spray contained about $1\frac{1}{2}$ lb. As_2O_5 in 100 gals. and was applied to two trees. The percentages of fruits infested were: 4·1 and 4·6 for freshly prepared triplumbic arsenate; 8·5 and 10·5 for diplumbic arsenate; 19·8 and 20 for calcium arsenate; 14·4 and 24·3 for magnesium arsenate; 28·3 and 28·8 for aluminium arsenate; 7·4 and 21·8 for copper arsenate; 89·5 and 94·6 for the untreated control trees. On another variety, lead and aluminium arsenates were applied in Bordeaux mixture at the beginning and end of May and in mid-June, and in water in mid-July. Each spray contained about $1\frac{1}{4}$ lb. As_2O_5 in 100 gals. The infestation percentages were: 69·9 and 50·5 for diplumbic arsenates; 69·6 for aluminium arsenate paste; 41·2 for aluminium arsenate freshly prepared from sodium arsenate and aluminium sulphate; and 96·4 for the control.

In a number of spray programmes on a third variety, applications were made in mid-April, mid-May, early and late June, and mid-July. Copper oxychloride was included in the first 3 applications. The infestation percentages were 65·2 in the control, 15·3 for cryolite, and 13·2 for lead arsenate. For 2 sprays of lead arsenate the percentages were: 68·8 when used alone; 11·8 when followed by 3 of cryolite; 3·1 when followed by 3 of lead arsenate and white oil; 4·6 when followed by 3 of cryolite and white oil; and 22 when followed by 3 of nicotine tannate. In France, arsenical spraying is not normally permitted in the last three periods. The white oil damaged the trees and fruit. The results show that the metallic base of the arsenates plays a secondary part in comparison with the fineness of division and the duration of suspension, and that supplementary spraying is essential.

VIENNOT-BOURGIN (—). **Note sur** *Cryptococcus fagi* **Baerensp.**—*Bull. Soc. Sci. nat. Seine-et-Oise* (3) **3** no. 4–5 pp. 59–60. Versailles, 1935.

Cryptococcus fagi, Bär., first recorded from France in 1908, has since become common and in Seine-et-Oise is a serious pest of beech. The trunks of trees should be sprayed in winter with a 4 per cent. white oil emulsion.

SPEYER [W.]. **Die Blutlaus-Schlupwespe im Niederelbischen Obstbaugebiet.** [*Aphelinus mali* in the Lower Elbe Fruit-growing District.] —*Altländer Ztg* 10th August 1935, reprint 1 p. Jork, 1935.

Up to 1928 the woolly apple aphis [*Eriosoma lanigerum*, Hsm.] was rare in the apple orchards on the Lower Elbe, but it increased in subsequent years. Its parasite [*Aphelinus mali*, Hald.] was imported into the district in the spring of 1934. It has become established, and it has been found that some winter tar distillate sprays, such as 5 per cent. Dendrin, do it little injury.

SPEYER (W.). **Tätigkeitsbericht der Biologischen Reichsanstalt für Land- und Forstwirtschaft, Zweigstelle Stade . . . vom 1. April 1934 bis 31. März 1935.** [Report from 1st April 1934 to 31st March 1935 of the Stade Branch of the Imperial Biological Institute for Agriculture and Forestry.]—*Altländer Ztg* 1935, nos. 60, 64, 68 & 71, reprint 4 pp. Jork, 1935.

Observations during several years have now established that biological races of *Cheimatobia brumata*, L., exist [*cf. R.A.E.*, A **21** 174] and that, as the adults and larvae appear at different times, local failures in control are due to ignorance of the biology of the race concerned. Pre-blossom spraying with nicotine was found to be the best measure against fruit-tree Capsids such as *Plesiocoris rugicollis*, Fall., and *Lygus pabulinus*, L.

KNÖRLE (G.). **Eine neue einfache Massnahme zur Behebung von Drahtwurmschäden bei Halmfrüchten.** [A new, simple Measure to prevent Injury to Cereals by Wireworms.]—*Landbau u. Technik* **11** no. 4 1935. (Abstr. in *Anz. Schädlingsk.* **11** no. 9 p. 106. Berlin, September 1935.)

A one-acre field of barley in the Black Forest, which it was proposed to plough because of very severe infestation by wireworms, was treated instead with 120 lb. calcium nitrate, rolled, and hoed 8–10 days afterwards. In a few days the barley was flourishing and the subsequent yield was good. It is believed that the manure and the rolling drove the pests to great depths, the manure then encouraging growth.

VAN POETEREN (N.). **Verslag over de werkzaamheden van den Plantenziektenkundigen Dienst in het jaar 1934.** [Report on the Work of the Phytopathological Service in 1934.]—*Versl. PlZiekt. Dienst* no. 80, 108 pp., 3 pls. Wageningen, September 1935.

Pests recorded from Holland in 1934, many of which have been noticed from previous reports [*R.A.E.*, A **22** 665; etc.], included *Cephus pygmaeus*, L., on winter wheat and rye and, especially, summer

wheat ; *Phytometra* (*Plusia*) *gamma*, L., and *Cassida nobilis*, L., on beet ; *Depressaria nervosa*, Haw. [**23** 481] and *Pemphigus bursarius* L., on caraway ; *Hylastes trifolii*, Müll, on clover ; *Lasius fuliginosus*, Latr., destroying the pistils and stamens of peach ; a sawfly, probably *Pachynematus pumilio*, Knw., infesting blackberry and causing 10 per cent. of the berries to drop ; *Rhopalosiphoninus tulipaella*, Theo., on the shoots of crocus bulbs ; *Merodon equestris*, F., infesting narcissus bulbs ; *Aphthona coerulea*, Geoffr., which attacked *Iris sibirica* and other irises and was effectively controlled by a derris dust containing 2 per cent. rotenone, a dust with a content of 0·3 per cent. or even less appearing satisfactory in other cases ; *Endrosis lacteella*, Schiff., *Tinea granella*, L., and *T. cloacella*, Haw., mining dried roots of anemone ; *Pyrausta nubilalis*, Hb., in chrysanthemum stems ; fly larvae, probably *Phorbia* (*Chortophila*) *cilicrura*, Rond., or *P.* (*C.*) *trichodactyla*, Rond., mining the stems of *Tropaeolum canariense* ; and *Agelastica alni*, L., which infested alders everywhere and proved troublesome by defoliating those used as windbreaks.

The infestation of Douglas fir by *Chermes* (*Gilletteëlla*) *cooleyi*, Gill., increased in 1934 as it had in 1933, probably owing to dry weather in August, followed by little rain or frost in autumn and winter, so that mortality during hibernation was slight. No galls were found on spruce (*Picea*) [*cf.* **22** 665] so that the gall-forming generation is probably absent in Holland as in England. Experiments showed that derris had no effect on *C. cooleyi*, and oil sprays only a slight one, but that a nicotine dust or spray was highly effective. The cost must be balanced against the loss of wood in trees infested for several consecutive years, which in turn depends on weather. It was observed in April 1935 that considerable mortality had occurred so that the infestation was likely to decrease.

On hops a spray of 1 per mille nicotine with a spreader controlled *Phorodon humili*, Schr., and one of 20°Bé. California mixture [lime-sulphur and salt : *cf.* **3** 215, 396] at a concentration of 2 per cent. was equally efficient against *Tetranychus telarius*, L. (*Epitretranychus althaeae*, v. Hanst.).

A list of the insecticides and fungicides tested during the year is given, with notes on the results obtained.

[Ivanov (S. P.) & Krishtal' (O. P.).] **Іванов (С. П.) та Криштaль (О. П.). Materialien zur Kenntnis der schädlichen Entomofauna des Bodens auf den Feldern der Waldsteppe und des Pollissje der Ukraine am rechten Dniprouferer.** [Contribution to the Knowledge of the noxious Insect Fauna occurring in the Soil of Fields in the Forest Steppe and Poles'e on the right Bank of the Dnieper in the Ukraine (Families Elateridae, Alleculidae Tenebrionidae and Scarabaeidae). (*In Ukrainian.*)]—*Zbirn. Pratz' Sekt. Ekol. nazemn. Tvar.* pt. 1 pp. 97–133, 4 maps, 15 refs. Kiev, Vidavn. VUAN, 1933. [Recd. September 1935.]

This is a detailed survey, based on investigations of the authors and others in 1926–32 (chiefly 1930), of various beetles occurring in the soil of cultivated fields and fallow land in three Departments in western Ukraine, the material being collected from sample pits in typical fields. The topography of the region is discussed, and details are given of the distribution and density of the insects in 15 localities, which are briefly described. Tables show the families and species taken, their numbers

(total and per square metre), and the dates and places of capture, and maps illustrate the distribution and relative density of the species in 1930. Larvae of Lamellicorns and Elaterids constituted 51·6 and 43·2 per cent. respectively of the total number taken. In the northern part of the area, which is known as the Poles'e and consists of forests and sphagnum swamps, where rye is the chief crop, and oats, buckwheat barley, potatoes, flax and hemp are also grown, the most important wireworms were *Corymbites* (*Selatosomus*) *aeneus*, L., and *Limonius* sp. (? *aeruginosus*, Ol.), and the chief Lamellicorn was *Anomala* (*Phyllopertha*) *horticola*, L. In the forest steppe zone, where the same crops and other cereals are grown, but where sugar-beet is cultivated to a large extent, the most important of the wireworms were *Agriotes gurgistanus*, Fald., *A. ustulatus*, Schall., and *Melanotus brunnipes*, Germ., and of the Lamellicorns, *Anisoplia austriaca*, Hbst. Species that caused considerable damage over the whole area were *Corymbites* (*S.*) *latus*, F., *Agriotes sputator*, L., *Amphimallus solstitialis*, L., *Melolontha* sp. and *Anisoplia segetum*, Hbst. The Lamellicorns are particularly injurious to sugar-beet, to which the larger species, *Melolontha* and *Amphimallus solstitialis*, cause the most severe damage.

[Rudnev (D. F.).] **Руднев (Д. Ф.). Materialien zur Oekologie von *Lophyrus pini* L. im Zusammenhang mit den Besonderheiten seiner Verbreitung in Waldbeständen.** [Data on the Ecology of *Diprion pini* in Connection with the Peculiarities of its Spread in Forest Stands.] [*In Ukranian.*]—*Zbirn. Pratz' Sekt. Ekol. nazemn. Tvar.* pt. 1 pp. 135–144, 8 refs. Kiev. Vidavn. VUAN, 1933. (With a Summary in German.) [Recd. September 1935.]

Following an outbreak of *Diprion* (*Lophyrus*) *pini*, L., in a pine forest of the dry type in the Department of Kharkov, investigations were carried out in the spring of 1931 on the distribution of infestation and the rate of mortality among the hibernating larvae in cocoons. On the edges and in the thin parts of the forest, the percentage of needles destroyed had varied from 60 to 100, whereas in the dense parts it had seldom exceeded 30. To determine the degree of infestation, cocoons of *D. pini* were collected in different parts of the forest from sample plots, each measuring 1 sq. m. and situated at a distance from the trunk of a tree equal to half the radius of the crown. The results are shown in tables. The average numbers per plot of the summer cocoons of the previous year (distinguished by the exit holes of the adults) were 111 and 122 in the thin and dense parts of the forest, respectively, whereas for the hibernating cocoons the corresponding figures were 526 and 266. The infestation had thus increased much less in the dense parts. It is thought that in a forest of the dry type an outbreak of *D. pini* is built up at the edges or in the thin parts and gradually spreads towards the centre. This is also true of *Cerambyx cerdo*, L., whereas infestation by the moths, *Dendrolimus pini*, L., *Panolis flammea*, Schiff., or *Lymantria* (*Ocneria*) *monacha*, L., spreads from the centre outwards.

The percentages of mortality in the hibernating cocoons were about 70 in the thin parts of the forest and on the periphery, and about 75 in the dense parts. In all, about 43 per cent. were killed by predators (mainly birds and mice) and 26 per cent. by bacterial and fungous diseases. Parasites (chiefly Chalcidoids and Braconids) killed only 0·6 per cent. in the thin stands and 5·1 per cent. in the dense ones.

The number of hibernating cocoons was 70–80 per cent. less in an area of the forest, covering about 20 acres, from which the litter had been removed in October 1930, and the rate of mortality in them was at least as high as in those in the rest of the forest. Since, however, the removal of the litter is liable to affect the trees, this measure should only be applied in extreme cases. It is of little value unless done very thoroughly, and even then some of the larvae form their cocoons in the soil.

ŞEVKET (Nihat). **Şekerpancari hastaliklari.** [Pests and Diseases of Sugar-beet.] [*In Turkish.*]—Cr. 8vo, 164 pp., 7 pls. (6 col.), text-ill., 26 refs. Istanbul, Resimli Ay Matbaasi T.L.S., 1934. [Recd. October 1935.]

This handbook deals almost entirely with insect pests of sugar-beet, including a number that have not been recorded in Turkey. They are arranged under their families and notes on the bionomics and in some cases control are given. Among the more important in Turkey are *Phthorimaea ocellatella*, Boyd, *Loxostege nudalis*, Hb., *Hellula undalis*, F., *Laphygma* (*Caradrina*) *exigua*, Hb., *Phytometra* (*Plusia*) *gamma*, L., *Pegomyia hyoscyami*, Panz., Tipulids, particularly *Tipula oleracea*, L., a number of Elaterids, the Alleculid, *Omophlus caucasicus*, Kirsch, *Otiorrhynchus ligustici*, L., *Bothynoderes* (*Cleonus*) *punctiventris*, Germ., *Conorrhynchus* (*Cleonus*) *nigrivittis*, Pall., *Lixus subtilis*, Sturm, *Lygus pratensis*, L., and *Aphis fabae*, Scop.

Keys to the pests and diseases are given, and an index is appended.

Insect Pests and their Control.—*Agric. Gaz. N.S.W.* **46** pt. 8 pp. 441–445, 8 figs. Sydney, 1st August 1935.

This part of a series on insect pests in New South Wales [*cf. R.A.E* A **23** 633] includes a brief note on the bionomics of *Cydia molesta*, Busck, which has been known to attack peach, nectarine and quince in the coastal districts for several years but has seldom caused appreciable damage, Hymenopterous parasites being a factor in its control. The measures suggested comprise orchard sanitation, the use of trap bands, and the destruction of infested twigs, which should be cut off and burnt as soon as they wilt, as by the time they wither the larvae have left them.

ALLMAN (S. L.). **The Codling Moth Problem. Results of Trials at Bathurst.**—*Agric. Gaz. N.S.W.* **46** pt. 8 pp. 459–463, 2 figs. Sydney, 1st August 1935.

Further experiments on the control of *Cydia pomonella*, L., on apple in New South Wales [*cf. R.A.E.*, A **20** 166] were carried out in 1933–34, 12 different treatments being used. One calyx spray was applied on 20th October and 4 cover sprays on 10th and 30th November, 21st December and 23rd January. In 10 of the treatments, lead arsenate (24 oz. to 50 gals.) was used in all 5 sprays or in the first 2, the other treatments were 24 oz. natural or synthetic cryolite and 4 oz. casein-talc spreader in 50 gals. water for all sprays. The most efficient control was obtained when lead arsenate formed the basis of all sprays. When it was used alone in the first 2 sprays and combined with any of 3 white oils (1 : 80) in the last 3, infestation was reduced from 67 (on

unsprayed trees) to about 5 per cent. Fish oil (1 : 400) was less efficient than the white oils but more efficient than kerosene (1 : 80) or casein-lime (1 lb. in 80 gals.). Nicotine sulphate (1 : 640) and white oil were inferior to lead arsenate, but superior to cryolite. When all 5 sprays contained lead arsenate, an arsenic residue 2–4 times greater than the legal limit was left. When lead arsenate was used in the first 2 sprays, and nicotine sulphate in the last 3 the residue was below the limit but infestation was 18–19 per cent. The fruit from several plots sprayed with lead arsenate and white oil in the last 3 cover sprays had a heavy oily deposit that was difficult to remove by wiping. A large amount of fruit dropped from trees sprayed with lead arsenate and fish oil, probably owing to scorching of the leaves.

In tests of bands treated with beta-naphthol, only 2·75 per cent. of the 2,911 larvae found beneath the bands survived to produce moths. The bark was uninjured.

CHEO (Ming-tsang). **A preliminary List of the Insects and Arachnids injurious to economic Plants in China.**—*Peking nat. Hist. Bull.* **10** pt. 1 pp. 5–37. Peiping, September 1935.

This first part, which is carried, alphabetically, as far as the Homoptera, comprises a list of 4 mites and 277 insects, showing the plants they attack and the extent of their distribution in China.

HARUKAWA (C.), TAKATO (R.) & KUMASHIRO (S.). **Studies on the Rice-borer. III. On the Population Density of the Rice Borer.**—*Ber. Ōhara Inst. landw. Forsch.* **7** no. 1 pp. 1–97, 22 graphs, 13 refs. Kurashiki, 1935.

In studies in Japan of the population density (number of larvae per unit area of rice-field) of the rice-borer [*Chilo simplex*, Butl.], light-trap catches were found to be a rough index of the moth population near the trap, but not a direct index of the abundance of larvae of the coming generation. The population density could be ascertained by collecting rice culms several times during the growth period and counting the larvae. During the six years from 1928 to 1933 the density was usually about 3,000 to 4,000 per tan [$\frac{1}{4}$ acre] for the first generation, but in the outbreak year, 1931, there were as many as 13,000 larvae of first generation and more than 200,000 of the second.

The number of moths in the first flight period was a rough index of the density of the larvae that had hibernated. Light-traps showed that the abundance of the borer and the fluctuation from year to year differed greatly in 11 localities in the southern plain of the Okayama Prefecture. Weather conditions could not have differed enough to be the sole factor causing such fluctuations, which must be regarded as peculiar to each place. In neither the first nor the second generation, did the abundance of adults appear to have any definite relation to weather. From 1909 to 1932, inclusive, there were only two years in which both the first and second generations of *C. simplex* were very abundant, and examination failed to disclose any definite relation between this abundance and weather.

The mortality among larvae and pupae and the percentage of parasitised larave were studied to ascertain whether parasites and predators regulated population density. It was found that the death rate of the larvae during their period of activity increased and decreased

with the fluctuation of population density, but with a lag of a year. This death rate had a close relation to the percentage of parasitised larvae and showed the same trend of fluctuation. It was not possible to find any definite relation between weather and the percentage of parasitised larvae.

The death rate in the hibernation period was studied with larvae hibernating in stubbles in the field and in heaps of straws. In general, larvae in both situations were subject to similar fluctuations. Their death rate did not seem correlated with weather conditions in the coldest months (January and February), but was high in years when the rainfall was abundant in April and very scanty in May and June.

Bodenheimer (F. S.). **A Visit to the Citrus District of Southern Turkey, April 1934.**—*Hadar* **8** no. 1 pp. 10–14, 4 figs. Jaffa, January 1935.

The most important pest of *Citrus* in southern Turkey is *Aonidiella* (*Chrysomphalus*) *aurantii*, Mask. It reaches its maximum in the autumn and its minimum in winter. Fumigation is recommended at the beginning of full fruit bearing. The application of lime-sulphur was found to have been ineffective. Other pests (some of which were not observed during the author's visit) comprise *Ceratitis capitata*, Wied., *Cryptoblabes gnidiella*, Mill., *Toxoptera aurantii*, Boy., *Chrysomphalus dictyospermi*, Morg., *C. pinnulifer*, Mask., *Pseudococcus citri*, Risso, *Icerya purchasi*, Mask., *Ceroplastes* spp. (including *C. sinensis*, Del G., *C. floridensis*, Comst., and possibly *C. rusci*, L.), *Parlatoria pergandei*, Comst., *Coccus* (*Lecanium*) *hesperidum*, L., *Saissetia oleae*, Bern., and *Lepidosaphes gloveri*, Pack. The identification of the last-named is uncertain, since in Palestine the male larvae and pupae of *L. beckii*, Newm., have acquired the blue-violet body colour that had been considered typical of *L. gloveri*. The introduction of *Rodolia* (*Novius*) *cardinalis*, Muls., greatly reduced *I. purchasi* in one grove where it had been prevalent the previous year.

Rivnay (E.). **The Extent of the Infestation of the Cederate** (*Citrus medica*) **with the Fruit Fly** (*C. capitata*) **in Palestine.**—*Hadar* **8** no. 2 pp. 49–52, 2 figs. Jaffa, February 1935.

Investigations were made in Palestine in 1931–33 on the extent of infestation of cederate by *Ceratitis capitata*, Wied., with special reference to the fruit imported into the United States. Its importation had been permitted because it was thought that its rind was too thick for the larvae to develop in it. They were, however, intercepted in cederate fruits from Italy in 1930 and 1931.

Before October when the fruit was raw the flies were not attracted. They oviposited readily in ripe fruit with only 30–40 oil glands per cm.^{2} but not at all in fruit with more than 65; raw fruit had over 75. In the laboratory flies could be forced, when ripe fruit was not available, to oviposit in very raw fruit. When ripe and raw fruits were hung together in the same cages and subject to the same flies and conditions, 79 oviposition holes were made in the ripe fruits and only 8 in the raw. The percentages of oviposition holes not containing eggs were 12 and 50 respectively, and for fruit in the groves 8. Evidently the raw fruits contain some repellent. Of 4,768 eggs in 230 fruits picked in the grove, only 111 did not hatch, but of 10,604 larvae only 17 recently hatched

ones were alive. Most of these died before they began to burrow in the rind, and none was found in the pulp. Perhaps they were killed by the gum that exuded at the injury, or the oil in the rind. The average burrow was 5 cm. long, and since the rind in the ripe fruit was on average 15 cm. thick, the chances of piercing the rind were small.

The fruit exported to the United States is mainly required for Jewish rites ; it must be unblemished and exported in August and September, when it is still raw and green. It is therefore unlikely to be infested, and if it were, the larvae would have practically no chance of survival.

DUFF (C. E.). **Preservative Tests and Durability Trials with Native Timbers of the Copper Belt of Northern Rhodesia.**—*J. Brit. Wood Pres. Ass.* **5** pp. 69–75. London, 1935.

Coniferous wood from Canada is imported into the Northern Rhodesian copper belt for use in the copper mines. Experiments were made to determine the response to cheap preservative treatment and resistance to termites of native and imported timber, both treated and untreated. The preservatives used were sodium arsenite, arsenic trioxide, zinc chloride and copper sulphate. Blocks, 6 × 4 × 2 ins., of different timbers were buried in light loam in a plot heavily infested with termites. Dry sticks placed in the ground were destroyed in 24 hours. After 4 months of dry weather, the sapwood of *Ficus* sp., Oregon pine [*Pseudotsuga taxifolia*] and Baltic deal [? *Picea abies*] was seriously damaged. After 1 year, in which heavy rains had occurred, the untreated sapwood of *Marquesia macroura, Erythrophloeum africanum* and *Baikiaea plurijuga* was intact. In these cases and also in *Albizzia antunesiana, Afrormosia angolensis, Terminalia rhodesica, Entandrophragma caudatum, Pterocarpus angolensis,* and pitch pine [*Pinus rigida*], the untreated heartwood was practically intact. That of Oregon Pine and Baltic deal was considerably damaged. All blocks treated with arsenic compounds were intact. They included the common species *Isoberlinia paniculata, I. tomentosa, Brachystegia bournei, B. hockii* and *B. utilis.* Zinc chloride was less efficient than the arsenic compounds, but more efficient than copper sulphate.

CHAMBERLAIN (E. E.). **Sore-shin of Blue Lupins. Its Identity with Pea-Mosaic.**—*N. Z. J. Agric.* **51** no. 2 pp. 86–92, 4 figs., 3 refs. Wellington [N.Z.], 20th August 1935.

In experiments in New Zealand a destructive mosaic disease of blue lupins (*Lupinus angustifolius*) known as " sore-shin " was transmitted by inoculation to 6 out of 24 healthy pea plants. In order to check the identity of the mosaic that developed, 20 sweet pea plants were inoculated with the juice of the infected pea plants and 2 showed symptoms of pea mosaic. The virus was then transmitted back to 9 lupin plants, 2 of which developed symptoms of " sore-shin." The disease was readily transmitted to lupins by *Aphis rumicis,* L., from infected broad beans and by *Myzus persicae,* Sulz., from garden peas. The incubation period varied from 6–10 days. In preliminary experiments the virus was not transmitted by *Thrips tabaci,* Lind., which was the only insect found on blue lupins in the field. The disease produced by Aphid transmission was further transferred to 16 healthy lupin plants, 4 of which developed the typical symptoms of " sore-shin." Bean and pea mosaics and " sore-shin " are apparently caused by the same virus.

Infected lupins do not produce seed unless they have only become infected late in the season, and in experiments the virus was not carried by the seeds. As lupins are not grown throughout the season, it is probable that it overwinters in red clover [*Trifolium pratense*], which becomes heavily infected. In the spring of 1934, 93 per cent. of lupins and 89·5 per cent. of garden peas planted at a distance of 22 yds. from mosaic-infested clover developed " sore shin " and pea mosaic respectively.

COTTIER (W.). **Aphides affecting cultivated Plants. (5) Aphides of the Bean, Turnip, Strawberry, Pumpkin, and Primrose.**—*N. Z. J. Agric.* **51** no. 2 pp. 92–97. Wellington [N.Z.], 20th August 1935.

Short notes are given on the bionomics in New Zealand of *Aphis rumicis*, L., on beans, *Myzus persicae*, Sulz., *Brevicoryne brassicae*, L., and *Aphis pseudobrassicae*, Davis, on swedes, rape, cabbage and other cruciferous plants, *Capitophorus potentillae*, Wlk. (*fragariae*, Theo.) on strawberry, *Aphis gossypii*, Glov., on pumpkin, and *Myzus primulae*, Theo., on primroses, and the winged and wingless viviparous females of each species are briefly described. *B. brassicae* passes the winter in its normal summer stage on winter greens, but reproduction is greatly retarded by the lower temperatures. In the spring winged forms start colonies on new crops. *A. gossypii* apparently overwinters in the summer form on suitable winter food-plants. Winter eggs are reported to have been found, but it is doubtful whether the insect normally overwinters in the egg stage. In bad infestations by *Capitophorus* all leaves of strawberry should be removed and burnt at the end of the season and the crowns should be sprayed with nicotine sulphate (1 : 800) and soft soap (3–4 lb. per 100 gals. spray). Hot water treatment of the runners [*R.A.E.*, A **22** 234] immediately before planting is also recommended.

MUGGERIDGE (J.). **The White Butterfly Menace. Efficient Control by the pupal Parasite,** *Pteromalus puparum*.—*N. Z. J. Agric.* **51** no. 2 p. 109. Wellington [N.Z.], 20th August 1935.

The progress made by *Pteromalus puparum*, L., in controlling the white butterfly [*Pieris rapae*, L.] on crucifers in New Zealand up to the early part of 1935 is briefly reviewed [*R.A.E.*, A **23** 372, etc.]. In the south-western part of North Island, where a small number of parasites were liberated in 1934, 14 per cent. of the pupae collected were parasitised. During 1934–35, *P. rapae* was abundant in this area but 96 per cent. of nearly 22,000 pupae examined in the winter of 1935 were parasitised. Of about 20,000 pupae obtained from points outside the area of liberation none was parasitised.

CURRIE (G. A.). **Symbiotic Association between Flies and Nematodes in Galls of Eucalyptus Trees.**—*Nature* **136** no. 3433 p. 263. London, 17th August 1935.

In Australia the formation of galls on the flower buds of *Eucalyptus rostrata* and *E. hemiphloia*, which are caused chiefly by Agromyzid flies of the genus *Fergusonina*, is sometimes so heavy that no flowers appear and no honey harvest is obtained. Nematodes of a subgenus of *Anguillulina* are found associated with the fly larvae inside the galls

[*cf. R.A.E.*, A **21** 265]. A number of fertilised female Nematodes enter the body-cavity of female larvae of the fly and oviposit. When the female fly deposits eggs in young flower buds, larval Nematodes are introduced with them. These at once begin to feed on the plant tissues and give rise to proliferating cells on which the fly larvae feed, making hollows in which they are associated with the worms. The symbiosis appears to have arisen accidentally. The parasitic association between the frit-fly of oats [*Oscinella frit*, L.] and a Nematode [*Tylenchinema oscinellae*, Goodey] [**18** 567] may correspond to one of the steps in its evolution.

Pescott (R. T. M.) **The Woolly Aphis of the Apple** (*Eriosoma lanigera* **Hausm.**).—*J. Dep. Agric. Vict.* **33** pt. 8 pp. 379–382, 5 figs., 4 refs. Melbourne, August 1935.

Eriosoma lanigerum, Hsm., was first known to be definitely established on apple in Victoria in 1846. The methods by which it spreads, the type of injury it causes and the resistance to it of certain varieties of apple are briefly discussed. Its parasite, *Aphelinus mali*, Hald., was introduced into Victoria in 1924–25 and usually keeps it under control in most orchards. Instructions for dealing with a consignment of parasitised Aphids are given for growers. If a spray is necessary, miscible red oil (1 : 20) should be applied in winter at high pressure with the spray nozzle held close to the affected parts so as to break up the woolly covering of the Aphids [*R.A.E.*, A **23** 633].

Robertson (W. C.). **Lime Sulphur Wash and Powders.**—*J. Dep. Agric. Vict.* **33** pt. 8 pp. 386–391, 2 figs. Melbourne, August 1935.

The types of lime-sulphur now on the market in Victoria are compared. The method of preparing concentrated liquid lime-sulphur is described, showing the difficulties involved in obtaining satisfactory results, and analyses are given of a number of local and English commercial preparations together with samples of farm-made products with a view to standardisation. Approximate analyses of soluble sulphur compounds are also given for self-boiled lime-sulphur powder and dry-mix sulphur-lime.

Gay (F. J.). **The Peach Moth** (*Cydia molesta*, **Busck**). **Investigations in the Goulbourn Valley, Victoria. Progress Report for the Season 1934–35.**—*J. Coun. sci. industr. Res. Aust.* **8** no. 3 pp. 171–176, 3 refs. Melbourne, August 1935. Also in *J. Dep. Agric. Vict.* **33** pt. 8 pp. 365–369, 3 figs., 3 refs. Melbourne, August 1935.

Following the destruction by *Cydia molesta*, Busck, of 40–80 per cent. of the canning crop of peaches in the Goulbourn Valley, Victoria, in the 1933–34 season, when, apart from twig injury, loss owing to infestation of the fruits was estimated at £70,000, an investigation was carried out in 1934–35. Previous work had indicated that 3 generations a year are normal in this area, but in the 1934–35 season larvae of a small fourth brood developed and moths were captured continuously from November to March. Females lived 13–33 days and laid 30–150 eggs (average 85) over a period of 8–22 days. The life-cycle from egg to adult averaged 37 days, but 10 per cent. of the second brood, 80 per

cent. of the third and all the fourth hibernated. Larvae of the early and mid-season broods form their cocoons high in the trees, but those of the last brood generally descend from the branches and form cocoons under rough bark or in sheltered situations on the soil surface. Newly-hatched larvae wander freely and test sites for entering twigs or fruit by biting out pieces of tissue. As, however, they always discard such tissue and do not begin to feed until entirely buried, it is not likely that they will swallow stomach poisons. Of contact insecticides tested in the laboratory against the eggs, the most effective was nicotine sulphate, which gave 99 per cent. mortality. Some confirmation of its effect was afforded by the fact that infestation by *C. molesta* was slight in several orchards where it had been applied in November 1934 for the control of the green peach aphis [*Myzus persicae*, Sulz.]. On certain trees sprayed with dry-mix sulphur-lime in a fungicide test, infestation of the fruit by *Cydia* was reduced by 50 per cent. Laboratory work suggested that the spray repelled the ovipositing females.

In the Goulbourn Valley, several native Hymenoptera parasitise the overwintering larvae and pupae, but no parasite of the early broods has been detected. *Dibrachys* sp. is responsible for 90 per cent. of the parasitism. It is favoured by the concentration of host larvae in shelter bands ; in one set of observations it parasitised 83 per cent. of the larvae in untreated bands and only 12 per cent. of those on unbanded tree-trunks. Chemically treated bands either kill the hosts before parasitism or destroy the parasites themselves. Arrangements have been made to introduce *Macrocentrus ancylivorus*, Rohw., which attacks the larvae in the spring and summer, from the United States. The use of large numbers of bait traps failed to produce any increase in the proportion of uninfested fruit, and the destruction of all visibly damaged tips in one orchard destroyed some 6,000 larvae in 2–3 weeks without materially reducing the final infestation. Deep cultivation kills many overwintering larvae, and the use of smooth props and steam sterilisation of cases used for packing fruit further reduces the number of larvae surviving from one season to the next.

JAFFRAY (A. B.). **A Note on the Evaluation of Australian grown Pyrethrum Flowers.**—*J. Coun. Sci. industr. Res. Aust.* **8** no. 3 pp. 231–233. Melbourne, August 1935.

The "rapid acid method" of evaluating pyrethrum flowers is described, and the results obtained from 4 samples are given. The process consists essentially in extracting the pyrethrins with low boiling petrol ether, hydrolysing them by boiling with methyl alcoholic sodium hydroxide, and then acidifying and steam distilling. The acid resulting from the hydrolysis of pyrethrin I passes over readily with the steam ; that from pyrethrin II remains in the flask. The distillate is shaken out with petrol ether, which is then titrated with N/50 sodium hydroxide in a stoppered bottle with vigorous shaking. When acetone was substituted for petrol ether in the extraction of the flowers, the results agreed fairly well.

DAVIDSON (J.). **The Apple-thrips** (*Thrips imaginis* **Bagnall**).—*J. Coun. Sci. industr. Res. Aust.* **8** no. 3 pp. 234–236. Melbourne, August 1935.

In the course of investigations on thrips in Australia [*R.A.E.*, A **23** 148, etc.], the following results relating to the control of *Thrips*

imaginis, Bagn., on apple were obtained. In Victoria, and South and Western Australia, the numbers of thrips are small during the dry summer months, but they increase in autumn, giving an " autumn rise," which may take place at any time during May, June and July. A warm, wet autumn with early rains favours this increase. The species overwinters mainly as pupae in the soil or as dormant adults. The thrips resume activity in the warmer days of early spring and the " first spring rise " is produced. A " second spring rise " occurs when the progeny of these adults develop. When conditions favour development of large numbers of thrips in October, a heavy infestation on apple blossom may be expected ; this will be particularly serious during short periods of hot, dry weather. If the weather continues to be favourable, bush fruits and garden flowers may become infested. The climatic conditions during the autumn of 1935 have been favourable for the increase of thrips. Plants flowering about the orchards in spring should be examined to ascertain the number of thrips present. They usually enter the unopened buds at the base of the petals ; they damage the stamens and pistil, and the blossoms often do not set fruit. They also feed on the exposed parts of the petals, which turn brown, and continue to infest the flowers when they have opened.

Actual control measures should aim at driving the thrips out of the blossoms and protecting the latter during the critical periods of invasion. It is important to anticipate the movement of the insects, and to time the application of dusts or sprays. The insecticides recommended have only been tested in the laboratory and limited field experiments. A spray of finely-ground kaolin with a spreader applied to the unopened buds in heavy doses will prevent the thrips from entering. A dust of 70 or 80 per cent. kaolin or talc, 15 or 20 per cent. finely-ground derris (90 per cent. of which passes through a 200-mesh sieve and containing 3·5 per cent. rotenone) and 5 or 10 per cent. finely-ground pyrethrum (containing 0·2 per cent. pyrethrins) should be applied to the opened buds at the rate of ½ lb. to a tree. As the dust only remains effective for about 2 days, several applications will be necessary. Sprays have not been very successful in experiments, but a mixture of 2 lb. finely-crushed derris root and 5 lb. soap in 100 gals. water may be used. It should be made up just before application.

Cummins (J. E.) & Wilson (H. B.). **The *Lyctus* or Powder Post Borer in Relation to Australian Hardwoods. (Abstract.)**—*Rep. Aust. Ass. Adv. Sci.* **22** pp. 327–328. Melbourne, 1935.

Lyctus brunneus, Steph., attacks the sapwood of the indigenous hardwood trees of Australia shortly after they have been felled. After a few months or a year, the larvae pupate just below the surface of the timber. About a month later the adults emerge to reinfest the same trees, the eggs being laid in the pores. At no time of the year and at no stage of drying or seasoning is the timber immune from attack, though only the sapwood is infested. Investigation has shown that there is an intimate relation between the size of the pores in the timber and the susceptibility of the species to attack [*R.A.E.*, A **23** 147]. Control measures suggested are the destruction of potential breeding grounds by burning waste sapwood and débris, and the segregation of sapwood stock, which should be frequently inspected and subjected to heat treatment or chemical impregnation.

Bobb (M. L.). **Experiments on the Control of the Mexican Bean Beetle 1933–1934.**—*Bull. Va agric. Exp. Sta.* no. 296, 11 pp., 6 figs. Blacksburg, Va, January 1935. [Recd. October 1935.]

An account is given of insecticide tests in Virginia in 1933 and 1934 against *Epilachna corrupta*, Muls., on beans [*cf. R.A.E.*, A **17** 618]. Tables show the insecticides used, the injury caused by the beetles and the materials, and the weight of green beans obtained from the treated and untreated rows in 1934. In 1933 the insecticides were applied on 13th June when the plants were small, and again on 27th July when they were blooming; in 1934 three applications were made, on 11th and 21st June and on 16th July, after the beans had formed. Practically the same results were obtained in both years. Magnesium arsenate was the most effective material, either as a dust (with lime, 1 : 3–5) or a spray (1 lb. to 50 U.S. gals. water), and caused practically no damage to the plants. Other poisons that caused little or no injury and gave a high degree of protection from the beetle were: Manganar (68 per cent. manganese arsenate) as a dust (with lime, 1 : 2) or as a spray (2 lb. to 50 U.S. gals.); calcium fluosilicate, 15 per cent., as a dust (with Fuller's earth, 1 : 2); a proprietary insecticide (Cal-Mo-Sul 30) containing 14 per cent. tri-calcium arsenate, 13 per cent. zinc sulphate and 20 per cent. calcium sulphide, as an undiluted dust or as a spray (1 lb. to 50 U.S. gals); copper cyanide, 86·08 per cent., as a spray (2 lb. to 50 U.S. gals.); Dutox (80 per cent. barium fluosilicate) as an undiluted dust or as a spray (1½ lb. to 50 U.S. gals); Flusul (75 per cent. barium fluosilicate and 25 per cent. sulphur) as a dust (with lime, 1 : 3) or as a spray (2 lb. to 50 U.S. gals.); and Kaolith (94·26 per cent. sodium fluoaluminate) as a spray (1 lb. to 50 U.S. gals.). Several brands of 70 per cent. calcium arsenate applied as dusts (with lime, 1 : 7) or as sprays (1 lb. with 2 lb. lime in 50 U.S. gals.) caused some injury to the foliage; it is recommended, therefore, to use this insecticide only when magnesium arsenate is not available.

Woodside (A. M.). **The Plum Curculio in Virginia.**—*Bull. Va agric. Exp. Sta.* no. 297, 20 pp., 7 figs., 2 refs. Blacksburg, Va, January 1935. [Recd. October 1935.]

An account is given of laboratory and field studies during the seasons 1930–34 on *Conotrachelus nenuphar*, Hbst., in Virginia, where it is a more or less serious pest of apples and peaches. The methods used in investigating the life-history are described, and the results of observations are shown in tables. It was found that the overwintered adults usually begin to abandon their hibernation quarters under leaves and rubbish in and near the orchards in April and May when peaches are in full bloom or soon after, following weather with a mean daily temperature of 55–60°F., and that the time of maximum emergence coincides fairly closely with the shedding of the shucks. The weevils feed on the leaves and flowers of the peach trees, and later on the shucks and fruits, causing the very young ones to drop. They begin to oviposit in the fruits when the shucks are falling and continue to do so as long as they remain in the orchard. In the insectary the average number of eggs laid by a female was 31. The duration of the egg and larval stages in the fruit averaged 21 days. The larvae abandoned the fruit between 17th May and 30th July, and spent 7–30 days in the soil before pupating.

The pupal stage averaged 10 days. The adults emerge in July and August and feed on peaches and apples. They may take several weeks to make their way to the surface of the soil ; hard dry soil delays their emergence and may even prevent it. The total time spent in the soil averaged a little more than 33 days. The summer weevils feed more greedily than the overwintered ones, but seldom pair. There is usually no second brood of any importance, though some of the summer adults may deposit eggs.

The only control measures in Virginia have been spraying or dusting, the latter being effective only if the infestation is slight. Three arsenical sprays should be applied, immediately after the petals have dropped, when the shucks have split, and when most of the shucks have fallen. Supplementary control measures recommended are : removal and burning in winter of fallen leaves, thick grass, etc., to kill the hibernating weevils ; jarring the weevils off the trees, preferably early in the morning and on to a special sheet [*R.A.E.*, A **20** 35] ; gathering dropped peaches and submerging them in water to kill the larvae [*cf.* **20** 645], or burying them in paper-lined sacks ; and thoroughly cultivating the soil to a depth of 2 inches and more as close to the trunks as possible to kill the pupae, which should be done three times at weekly intervals.

Herms (W. B.) & Ellsworth (J. K.). **The Use of Colored Light in Electrocuting Traps for the Control of the Grape Leafhopper.**—*Agric. Engng* **16** no. 5 pp. 183–186, 9 figs. St Joseph, Mich., May 1935.

Experiments were made in 1934 on the use of coloured light in electrocuting traps for the control of *Erythroneura comes*, Say, on vines in California. The trap consisted of a luminescent tube surrounded by an insulated cylindrical cage 8 ins. diameter with alternate wires connected to a transformer supplying the voltage required. The traps were hung 2 ft. above the vines and the lights were on from 6 p.m. to 6 a.m. from March to October. The numbers caught were : between 18th March and 1st June, 764 with a 60 watt midnight blue tube, 867 with a 60 watt red discharge tube and 399 with a 60 watt frosted Mazda lamp ; and between 27th August and 23rd October, 1,789 with a 60 watt midnight blue tube, and 4,631 with 120 watt pale blue tube. The percentage of females caught were : on 30th March, 88 with a midnight blue tube, 7 with a red discharge tube, and 38 with a frosted Mazda lamp ; and on 23rd July, 63 with a midnight blue lamp and 9 with a red discharge tube. The normal field populations were 30–36 per cent. females. Much better control was effected with these traps (1 per acre) than with oil-pyrethrum or calcium cyanide dust [*cf.* *R.A.E.*, A **21** 589].

French (O. C.). **Mechanical Equipment for Grape Leafhopper Control.**—*Agric. Engng* **16** no. 6 pp. 213–214, 217–218, 4 figs. St Joseph, Mich., June 1935.

The relative merits of various equipment used in the production of atomised pyrethrum-oil sprays against *Erythroneura comes*, Say, in California are discussed. They comprise knapsack sprayers, sprayers of the compressed air and blower types, and equipment for application from aeroplanes.

Ritcher (P. O.) & Fluke jr. (C. L.). **Trees and the White Grub Menace.**—*J. For.* **33** no. 6 pp. 620–621, 3 refs. Washington, D.C., June 1935.

In various parts of the United States during recent years, pasture and cornland have been damaged by the larvae of *Lachnosterna* (*Phyllophaga*) spp. [*cf. R.A.E.*, A **20** 413, 430; **21** 515]. Several workers have shown a correlation between the distribution of damage by the larvae and of food-plants, particularly oaks, preferred by the adults. In Wisconsin the principal species were *L. fusca*, Fröl., *L. rugosa*, Melsh., *L. hirticula*, Knoch, and *L. tristis*, F. The adults preferred oak, particularly burr oak [*Quercus macrocarpa*], which they often completely defoliated. Where oak was absent, the larvae caused little damage. The replacement of burr oak by other species of trees is recommended.

Service and Regulatory Announcements April-June 1935.—*S.R.A. B.E.P.Q.* no. 123 pp. 27–47. Washington, D.C., U.S. Dep. Agric., August 1935.

In addition to details of the revised quarantine (No. 48) against *Popillia japonica*, Newm., and regulations supplemental to it now in force in the United States, which are given verbatim, plant quarantine restrictions issued by the Philippine Islands, Antigua and Egypt are quoted or summarised. A list is given of the insects and other pests the entrance of which into Egypt is prohibited, showing the plants, fruits, etc., that they attack.

Park (T.). **Discussion of Theo. L. Jahn's "Problems of Population Growth in Protozoa."**—*Cold Spr. Harb. Symposia quant. Biol.* **2** reprint 3 pp., 8 refs. Brooklyn, N.Y., 1934. [Recd. September 1935.]

Experimental work with *Tribolium confusum*, Duv. [*R.A.E.*, A **23** 278; **22** 360; etc.] is reviewed and discussed in connection with the results obtained by Jahn in his work on the growth of populations in Protozoa.

Davis (J. J.). **Insects of Indiana for 1934.**—*Proc. Ind. Acad. Sci.* **44** (1934) pp. 198–206. Indianapolis, Ind., 1935

Brief notes are given on a considerable number of insect pests recorded in Indiana in 1934. In addition to some of the species noticed from the preceding year's report [*R.A.E.*, A **22** 694], they include the following, which were unusually abundant: *Blissus leucopterus*, Say, which was undoubtedly the outstanding pest of the year, *Heliothis obsoleta*, F., *Melanoplus bivittatus*, Say, and *Systena blanda*, Melsh., all very injurious to maize; *Murgantia histrionica*, Hahn, on cauliflower and cabbage; *Tortrix* (*Archips*) *argyrospila*, Wlk., on apple in one locality, this being the first outbreak in Indiana for 12 years; *Erythroneura comes*, Say, and *Desmia funeralis*, Hb., on vines; and *Chrysobothris femorata*, Ol., on maple and apple. *Taeniothrips simplex*, Morison (*gladioli*, Mlt. & Stnw.) is now generally distributed throughout Indiana on gladiolus. *Leptocoris trivittatus*, Say, was more abundant and widespread than ever previously recorded, and appeared

to have 2 generations in central Indiana. It breeds on female or seed-bearing box-elders [*Acer negundo*] and avoids the male trees, but when abundant injures a variety of other plants and also becomes annoying in houses. *Popillia japonica*, Newm., was taken in traps in Indianapolis for the first time and is probably now established in Indiana.

Dustan (A. G.). **The Gladiolus Thrip.**—*Pamphl. Dep. Agric. Canada* (N.S.) no. 151 revd 11 pp., 6 figs. Ottawa, July 1935.

This is a revision of a previous pamphlet [*R.A.E.*, A **21** 478] on the bionomics and control of *Taeniothrips simplex*, Morison (*gladioli*, Mlt. & Stnw.) which is now found on *Gladiolus* throughout Canada, including British Columbia. Modifications in the recommended methods of control have already been noticed [**23** 284].

Mathur (R. N.). **Notes on the Biology of the Psyllidae (Homopt.).**—*Indian For. Rec.* (N.S.) **1** no. 2 pp. 35–71, 2 pls. Delhi, 15th August 1935. Price 8*d*.

Notes are given on the biology, natural enemies and distribution of 34 species of Psyllids that attack forest trees in India. Most of them are gall-forming species, and several are undescribed. In an introduction C. F. C. Beeson states that in natural forest the general incidence of Psyllids is low, but that heavy infestation is fairly common on individual trees or small groups that are subnormal in health. In seed beds and in artificial regeneration areas the damage can be serious. The gall-forming species appear to be more injurious than the free-living ones in that the affected buds, shoots and leaves are put out of action and are not replaced by later growth. The free-living leaf-sucking types with short life-cycles are more characteristic of trees with a prolonged vegetative period and are capable of infesting the successive flushes of foliage under favourable weather conditions. Where Psyllid attack on seedlings and young plants is serious and control measures are required, it is necessary to resort to methods of spraying similar to those used for agricultural crops.

Ramakrishna Ayyar (T. V.) & Anantanarayanan (K. P.). **Agricultural Meteorology in its Relation to Insect Pests.**—*Madras agric. J.* **23** no. 8 pp. 328–335, 1 graph, 2 refs. Coimbatore, August 1935.

This is a general discussion, supported by examples from recent observations, of the effects of meteorological conditions on outbreaks of insects in South India. In work on parasites of the coconut caterpillar, *Nephantis serinopa*, Meyr. [*R.A.E.*, A **17** 113; **18** 532; **22** 261], it was found that the Bethylid, *Perisierola* sp., is favoured by warm dry weather, whereas the Eulophid, *Trichospilus pupivora*, Ferrière, requires cold wet weather for normal activities. Laboratory rearing of the former was most successful at 80–85°F. and 70–80 per cent. humidity and of the latter at 78–82°F. and 92–94 per cent. In the case of the Braconid, *Microbracon serinopae*, Cherian, a greater percentage of males was produced in the laboratory in 3 consecutive years as the hot and dry weather advanced and finally no females occurred, though occasionally fresh individuals from the field were added to those reared in the laboratory.

Damage to rice seedlings by *Schoenobius bipunctifer*, Wlk. (*incertellus*, Wlk.) is most severe if the weather is wet and cool, partly because this reduces the rates of parasitism of the eggs and of mortality among the hatching larvae. The moths first oviposit on the rice 10–25 days after it is planted and the crop sown before the onset of the regular monsoon rains escapes infestation. In the case of the army worm, *Spodoptera mauritia*, Boisd., outbreaks are more common in broadcast rice sown in puddle in ill-drained soils. The moths suddenly migrate from distant sources when the weather is moist and warm, apparently owing to a specific attraction by the prevailing atmospheric conditions. The relation between temperature, humidity and infestation of rice by *Spodoptera* in Malabar from 21st January to 22nd March 1935 is represented graphically. Plants over 20 days old were not attacked, and the most active oviposition took place on nights preceding mornings with a temperature of 78–82°F. and a humidity of about 78–82 per cent. The eggs were usually laid on young rice in ill-drained plots; rice of the same age on dry areas was free from infestation. Oviposition ceased about the end of February, when the weather became hotter and drier.

A recent severe and unexpected outbreak of the mealybug, *Ripersia oryzae*, Green, on young rice over a large area in Malabar illustrates the need for knowledge of the correlations between weather factors and insect abundance. An outline is given of the kinds of observations that are required.

KALSHOVEN (L. G. E.). **Indomalaysian *Nothopeus*-Species (Col., Cerambycidae), Remarks on their Food-plants, Identity and Mimicry.**—*Ent. Med. Ned.-Ind.* **1** no. 3 pp. 50–54, 1 fig. Buitenzorg, 1st September 1935.

The species dealt with include *Coloborhombus* (*Nothopeus*) *fasciatipennis*, Waterh., bred from larvae in stems of clove trees (*Eugenia aromatica*) in Sumatra. The injury has been known for years, but not the identity of the pest.

VOÛTE (A. D.). **Twee Beschadigers van jonge mangga-loten : I. De Manggalotboorder (*Chlumetia transversa* Wlk.). II. De plompe manggarups (*Bombotelia jocosatrix* Gn.).** [Two Pests of young Mango Shoots, *C. transversa* and *B. jocosatrix*.]—*Landbouw* **10** no. 7 pp. 255–271, 2 pls., 7 refs. Buitenzorg, January 1934. (With a Summary in English.) [Recd. November 1935.]

The following is substantially the author's summary :—The Noctuid, *Chlumetia transversa*, Wlk., is a common minor pest of mango in Java. Eggs are laid on tender leaves of very young shoots and hatch within one day. The larva bores into the midrib and feeds on the tissues of the leaflet for 2 days only. It then makes its way downwards into the shoot, but seldom kills it unless the tree is in poor condition. It leaves the shoot to pupate in the soil or some other shelter. The larval and pupal stages both last 12 days. Two parasites have been observed but neither is important. Vigorous growth of mangos should be encouraged as only those in poor condition are seriously damaged. Spraying with 1 per cent. lead arsenate at weekly intervals during the period of throwing off new shoots has kept the trees free from infestation.

The larvae of *Bombotelea jocosatrix*, Guen., attack the youngest leaves, on which the eggs are laid, and pupate in the soil. The larval stage of this Noctuid lasts 10–11 days and the pupal 12. Spraying with lead arsenate is recommended if control is required.

CARESCHE (L.). **Les Rhynchotes ravageurs des inflorescences de manguiers.**—*Bull. écon. Indochine* **38** pp. 372–380, 2 pls., 4 refs. Hanoi, 1935.

Mangos are attacked in Cochin China by *Idiocerus niveosparsus*, Leth., and *I. clypealis*, Leth., the adults of which are described. Particularly severe injury occurred after the blossoming period of 1934 in the neighbourhood of Saigon. Mangos flower in southern Indo-China from December till the end of March, during which period the Jassids reach maximum numbers. Oviposition begins in the flower buds as soon as they start to develop. The eggs are laid in pairs, and hatch in 4–6 days. The nymphs remain on the inflorescences on which they hatched, feeding on the flower buds and main flower stem and secreting honeydew. The nymphal stage, with 4 moults, lasts 8–13 days, and the life-cycle from egg to adult about 15 days. The adults feed on the inflorescences, young shoots and leaves, passing from one inflorescence to another to oviposit, and, particularly with the help of wind, from tree to tree. At night they are attracted to lights. Several generations occur during the blossoming period of the mangos, but as soon as flowering is over, the numbers fall off rapidly. Only one or two generations of *I. niveosparsus* develop between one blossoming period and the next. During this interval the Jassids live on the young shoots. It appears probable that *I. clypealis* breeds only during the blossoming period, the adults surviving from one season to the next. Although these Jassids appear to breed only on *Mangifera* spp., they take refuge temporarily on a number of other plants.

Injury is caused by oviposition and feeding punctures, and by the draining of a considerable amount of sap. The flower buds wither and become brown, and if they are already open and fertilised, the development of the young fruit is stopped. The withering eventually spreads to the whole inflorescence, and, especially where the atmosphere is moist, a sooty mould develops over the patches of honeydew. The flowers, young fruit, and dried inflorescences break off at the axils and fall. The growth of young trees, which suffer chiefly from attacks out of the blossoming season, is very much hindered, and in older trees the young growth that should bear the blossom in the following season is destroyed.

Injury caused by a fungus, *Gloeosporium mangiferae*, which enters the tissues through any opening and often occurs on mangos in the absence of insects, is greatly accentuated by the presence of the Jassids, the feeding and oviposition punctures of which afford it an additional means of entry. It develops on all the parts of the plants attacked by *Idiocerus* and in addition attacks the ripening fruit and the branches.

Control measures are chiefly directed to killing the Jassids at the outset of the blossoming period. Sprays containing 0·4 or 0·5 per cent. white soap are recommended. Their toxicity can be increased by adding water in which tobacco has been steeped. Spraying should be repeated at 3-day intervals, examination of the blossom showing the number of treatments required. Dusting with sulphur has been found

effective in India [*R.A.E.*, A **22** 443]. On dark, windless nights the adult Jassids can be caught in light-traps [*cf.* **21** 551] fixed 6–9 ft. above the ground. When they attack the young growth outside the blossoming period, they may be controlled by a 3 per cent. soap-kerosene emulsion with the addition of tobacco.

Chu (Joo-tso) & Sung (Tsu-lien). **Notes on the Mulberry Curculionid, *Baris deplanata* Roelofs.** [*In Chinese.*]—*Ent. & Phytopath.* **3** no. 25 pp. 500–508, 6 figs. Hangchow, China, 1st September 1935. (With a Summary in English.)

Notes are given on the bionomics of *Baris deplanata*, Roel., which is a serious pest of mulberry in Chekiang and Kiangsu. It has one generation a year and overwinters as an adult in the pupal chamber. The adults emerge and begin to attack the buds about the middle of April, and deposit eggs in the lenticels of the twigs, which are pruned over, between May and October. The female lays an average of 70 eggs with a maximum of 112. The larvae hatch in 5–9 days, feed on the cambium for 29–72 days and pupate in the xylem. The length of the pupal stage varies from 8 days in summer to 59 in winter. Adult males have lived as long as 317 days and females for 217. In 2 localities the percentages of damaged twigs were 39·07 and 69·53, respectively. A parasite of the genus *Eupelmus* has been reared from the larvae.

del Cid (G.). **Book-attacking Insects in Cataluña (Catalonia).** [*In Catalan.*]—*Arx. Esc. sup. Agr.* (N.S.) no. 1 pp. 24–30, 7 figs. Barcelona, 1934. (With Summary in English.) (Abstr. in *Exp. Sta. Rec.* **73** no. 3 p. 349. Washington, D.C., September 1935.)

The Anobiid, *Nicobium* (*Anobium*) *castaneum* var. *hirtum*, Ill. (*A. hirtum*, Ill.), is recorded as causing injury to books in libraries in Catalonia. It completed its life-cycle in about 2 months and had 3 or 4 generations a year. Other pests attacking books included the Bostrychid, *Psoa dubia*, Rossi.

Boselli (F. B.). **Su alcuni parassiti animali del limone in Costiera Amalfitana.** [On some Arthropod Pests of the Lemon on the Amalfi Coast.]—*Picentino* **91** no. 7–8 pp. 232–239. Salerno, 1935.

Pests of lemon on the coast at Amalfi, Italy, included a mite, *Tetranychus* sp. ; *Chrysomphalus* [*dictyospermi*, Morg.], which has been observed in a few localities since 1925 ; *Aspidiotus hederae*, Vall., which is the chief Coccid in the lemon plantations, but only occasionally requires an oil emulsion spray ; and *Pseudococcus citri*, Risso, which is fairly common but not very injurious. Two moths, *Cryptoblabes gnidiella*, Mill., and particularly *Prays citri*, Mill., cause serious losses. *C. gnidiella* oviposits where fruits touch each other and the larva mines the skin without entering the pulp. The larvae of *P. citri*, which has several generations a year, develop on the flowers, destroying the anthers and pistils. Infestation is greatest in June, but may be severe in May in sheltered positions, especially if the weather is hot. Spraying with lead arsenate (3–5 lb. per 100 gals. water) only gives partial control because flowering is gradual on each branch, which may simultaneously bear young fruits at the base and flower-buds at the tip. Lime-sulphur is advised against mites, Coccids and fungi.

Faes (H.). **Station fédérale d'essais viticoles à Lausanne et Domaine de Pully. Rapport annuel 1934.**—*Landw. Jb. Schweiz.* **49** no. 6 pp. 619–664, 13 figs., 1 graph. Berne, 1935.

Vine pests observed in 1934 included *Phylloxera*, which was found in several new districts, the vine moths [*Clysia ambiguella*, Hb., and *Polychrosis botrana*, Schiff.], the adults of which were on the wing throughout May and again from 10th to 25th July, but which were not very injurious, the weevil, *Peritelus sphaeroides*, Germ. (*griseus*, Ol.), which attacked the young shoots in April in one locality, and the Eumolpid, *Adoxus* (*Bromius*) *obscurus*, L. Following a hot and dry spring, *Cydia* (*Carpocapsa*) *pomonella*, L., caused severe damage to apples and pears and produced a second generation in Valais. Owing to the prolonged flight of the adults, the usual arsenical sprays did not give entirely satisfactory results, and those obtained from a late application of white oils were uneven. The use of trap bands impregnated with beta-naphthol proved to be of great value. Against *Cydia* (*Laspeyresia*) *funebrana*, Treit., which is an important pest of plums in Switzerland, two sprays of nicotine and soap, on 9th and 17th July, decreased the percentage of infested fruit from 44 to 3·6. The plums were slightly stained and matured rather late, but were not otherwise affected. The blossom weevils, *Anthonomus pomorum*, L., on apples and *A. piri*, Koll., on pears, were widespread and sometimes injurious. An annotated list of the chief pests and diseases of cultivated plants observed during 1934 is given. Of these, *Psila rosae*, F., caused severe damage to carrots in the course of the last 3–4 years, as many as 60–70 per cent. of the plants being infested in some localities. On a plot dusted 4 times with naphthalene (on 15th and 28th August and 6th and 11th September), only 12 per cent. of the carrots were infested and that slightly, as compared with 60–80 per cent. badly damaged in an untreated plot. *Anthonomus rubi*, Hbst., destroyed 50 per cent. of the flowers of strawberry in some plantations in Valais.

Fransen (J. J.) & Buisman (C.). **Infectieproeven op verschillende iepensoorten met behulp van iepenspintkevers.** [Experiments in infecting various Varieties of Elm with the Aid of Elm Bark Beetles.]—*Tijdschr. PlZiekt.* **41** no. 9 pp. 221–239, 1 pl. Wageningen, September 1935.

In experiments in Holland in 1934, adults of *Scolytus scolytus*, F., and *S. multistriatus*, Marsh., that had been in contact with spores of *Ceratostomella* (*Graphium*) *ulmi*, were confined on elms in muslin bags. Infection was obtained with each species of Scolytid and in several varieties of elm, including *Ulmus glabra fastigiata*, which has not often been found infected with Dutch elm disease in nature.

Fransen (J. J.). **Onderzoekingen over de iepenziekte verricht aan het Laboratorium voor Entomologie te Wageningen in 1934.** [Investigations on Elm Disease conducted at the Entomological Laboratory at Wageningen in 1934.]—*Tijdschr. PlZiekt.* **41** no. 9 pp. 240–260. Wageningen, September 1935.

In continued experiments in Holland [*cf. R.A.E.*, A **22** 339], on keeping elm logs immersed in water, larvae of *Scolytus scolytus*, F., and *S. multistriatus*, Marsh., survived for 7 months if in their pupal cells at

the moment of submersion; otherwise submersion for 5 months sufficed to kill them. Submersion for 6 months caused the trunks to lose all attraction for the females. Various chemicals were tried against larvae in the bark, but none proved satisfactory. The beetles did not appear to show any preference among individual elm trees of a given variety or between *Ulmus glabra* and *U. hollandica belgica*, but *U. foliacea wheatleyi* seemed to be less attacked by *S. scolytus* and more by *S. multistriatus*, when the beetles had a free choice. Trap logs proved very attractive, but must not be allowed to become breeding foci. Sprays containing lead arsenate or Paris green, tested to protect young elm plants against maturation feeding, did not appear to prevent attack, but seemed to have a fungicidal action and to restrain the spread of *Ceratostomella* (*Graphium*) *ulmi*.

The mite, *Pseudotarsonemoides innumerabilis*, Vitzt., was carried by beetles on the wing and was reared experimentally on an agar culture of *C. ulmi*. It is therefore possible that it may introduce the spores into the mines of the Scolytids.

The Braconid, *Coeloides scolyticida*, Wesm., was found in a district where it was liberated in 1932.

CAMERON (E.). **A Study of the Natural Control of Ragwort** (*Senecio jacobaea* **L.**).—*J. Ecol.* **23** no. 2 pp. 265–322, 2 pls., 11 figs., 53 refs. London, August 1935.

This investigation into the factors which keep ragwort (*Senecio jacobaea*) under control in Britain was undertaken with a view to utilising them in suppressing it in New Zealand. The paper begins with a brief account of the initiation of the scheme to control noxious weeds in New Zealand by biological methods [*cf. R.A.E.*, A **20** 271, etc.], and previous attempts to suppress weeds in this way are summarised in a table. The main principles underlying the biological control of weeds are outlined, and the procedure to be adopted in such work is indicated. The possibility that the introduced species may migrate to plants of economic value is discussed. The life-history and characteristics of *S. jacobaea* are described, together with brief notes on the history of its introduction into New Zealand, its botanical status and relation to plants of economic value and the ways in which it is poisonous to livestock. An ecological study of the weed shows that the biotic factor is of great importance in its control. Long grass and short continuous turf completely prevents its establishment, while overgrazed pastures, owing to partial exposure of the soil surface, are heavily infested. In Britain, man, insects and sheep are the chief agents controlling the weed, while rabbits aid its spread by breaking the vegetation cover and exposing the soil.

A list is given of some 60 European insects, of 5 different orders, that have been recorded from ragwort, together with notes on their life-histories and alternative food-plants. Of these *Tyria jacobaeae*, L., and *Hylemyia* (*Pegohylemyia*) *seneciella*, Meade, are the most important, and the distribution, synonymy and distinctive characters of each are briefly described. In England, adults of *T. jacobaeae* emerge from hibernating pupae about mid-May to the end of June. The eggs are found in clusters on the lower surfaces of the lower leaves of *S. jacobaea* and occasionally of groundsel (*S. vulgaris*). In the laboratory the larvae also fed on *S. cineraria* (garden cineraria). In the field the eggs hatch in about 13 days, but at 23°C. [73·4°F.] in an incubator they

hatched in 5. The average and maximum numbers of eggs laid by a female were 200 and 301. The oviposition period of one moth occupied 6 days. The larvae hatch about the end of May or later according to the season, and are usually common until towards the end of July. The larval period occupies about a month. Various measurements for each of the 5 instars are given in a table. The larvae rapidly destroy the flowers, foliage and the top parts of the stems of the weed; in one locality there was a population of 12 larvae to a plant or nearly $1\frac{1}{4}$ millions per acre. They pupate under moss, etc., or just beneath the soil surface, and pass the winter in this stage. In tests by J. C. F. Newton the larvae would not eat lettuce, or various Compositae grown in gardens.

Of 15 parasites of *T. jacobaeae* that have been recorded in the literature, a list of which is given, only one (*Apanteles popularis*, Hal.) was reared from the English material. No parasites of the eggs were found, and although eggs were exposed to *Trichogramma* sp. in the laboratory no results were obtained. Of the collected eggs 1 per cent. were sterile. The only larval parasite reared was *A. popularis*, the average number to a host larvae being 5. The mature larvae emerge from the fifth instar larvae of the host about the end of July, hibernate in cocoons and pupate just before the appearance of the adults in early July. The percentage of parasitism in one locality was 4 in 1930, 5 in 1931 (19 in one area) and 41 in 1932. A hyperparasite, *Mesochorus facialis*, Bridgm., was dissected from the last stage larvae of *Apanteles*. Parasites reared from the pupae of *Tyria* included *Ichneumon* (*Melanichneumon*) *perscrutator*, Wsm., which has apparently never previously been reared and which parasitised 15 per cent. of the pupae examined in 1929 and 2–3 per cent. in 1930 and 1931; and *Psychophagus* (*Diglochis*) *omnivorus*, Wlk., which was abundant in the first season but owing to superparasitism gave a percentage control of only 3–4. Fungi destroy 16–20 per cent. of the pupae of the moth and predators such as birds and rodents account for about 60 per cent.

The adults of *Hylemyia seneciella* appear during the last week in June just when the flower heads of the ragwort are beginning to expand. The eggs are laid between the bases of the florets, usually one to a head. The larvae hatch in 3–4 days and have 3 instars. They drop from the flowers about the end of August in the south and the end of September in northern Scotland and pupate in the soil. Infested capitula are easily recognised by having a dark brown central spot, which grows larger with the growth of the larva. The latter eats the immature seeds and part of the base of the involucre. The percentage of infestation is 8–9 in southern England and 33–34 in northern Scotland, and each larva destroys 75 per cent. of the seeds in the capitulum it occupies. Parasites reared from the puparia were the Miscogasterids, *Lamprotatus splendens*, Westw., and *L. obscurus*, Wlk., the Ichneumonid, *Hemiteles fulvipes*, Grav. (which is a hyperparasite), and the Braconid, *Phaenocarpa ruficeps*, Nees, which infested 51 per cent. of the larvae.

A small amount of damage was caused to ragwort by *Agromyza aeneiventris*, Fall., *Homoeosoma nimbella*, Dup., *Phytomyza atricornis*, Mg., *Trypeta* (*Spilographa*) *zoe*, Mg., *Sphenella marginata*, Fall., and *Aphis jacobaeae*, Schr. Short notes are given on the damage they cause and the parasites reared from some of them.

The results of surveys of the damage caused to ragwort by insects and the methods employed in making them are described. The plants react to insect attack by producing secondary crops of flowers and

seeds. From extensive experiments on the effect of cutting back the whole or different parts of the plant to simulate insect attack, it was concluded that a badly attacked plant is able to produce a second crop of seeds equal to 34·7 per cent. of the original potential yield. Plants with little or no reserve energy, growing on very poor soil, if badly attacked, do not produce a secondary crop of seeds, but may send out small shoots from the base of the stem. These are often capable of producing more seed in the next year than the original plant. Damage to any part of the plant lowers the yield of seeds for that season. The areas in England where some degree of control has been effected are described for the purpose of comparison with conditions prevailing in New Zealand. The importance of eliminating factors that predispose to open soil conditions is strongly emphasised. Other methods of control by cultivation, grazing and chemical means are described, and indications of the future progress of the work are given. Details of collecting and shipping insects for export are described ; in all 294,382 pupae of *Tyria* and 58,000 puparia of *Hylemyia* were shipped to New Zealand. An extensive bibliography on weed control is appended.

Hey (G. L.). **Notes on Capsidae.**—*Ent. mon. Mag.* **71** no. 857 pp. 237–238. London, October 1935.

Instances are recorded of severe damage to black currants in Norfolk and Devon in 1934 and 1935 by the apple Capsid, *Plesiocoris rugicollis*, Fall. *Lygus pabulinus*, L., which is usually considered the commonest Capsid on black currant, was absent or scarce. On black currant in Cheshire, *Plesiocoris* was about ten times as numerous as *Lygus*. Young apple trees growing among the black currants were attacked by the former alone, and during 1935 it was the sole cause of damage to apples in several plantations, though previously it had not been recorded to any great extent from Cheshire, the damage to both black currant and apples being attributed to *L. pabulinus*. In Kent, bush apple trees that had been cut hard back in 1934 and top-grafted in the spring of 1935, were later severely infested by *P. rugicollis*, the eggs having apparently been present in the grafts as it is very improbable that they occurred in the trunks and main stems. Autumn infestation of pear trees by *L. pabulinus* was noted in Kent as result of uprooting and burning black currant bushes. These had been infested in spring but were destroyed in summer when the Capsid had, as usual, migrated to weeds. The bugs fed on the leaves and fruit of the pears, causing considerable damage.

Kennedy (N.). **Partridges eating Heather Beetle.**—*Scot. Nat.* no. 216 p. 169. Edinburgh, 1935.

In view of the fact that the crops of partridges shot in Ayrshire in 1935 were found to be full of heather beetles [*Lochmaea suturalis*, Thoms.], the larvae of which are destructive to heather, it is suggested that it would be well to protect these birds, and perhaps pheasants, on moorlands infested by the beetle.

Cameron (A. E.). **Insect Pests of 1934.**—*Trans. Highl. agric. Soc. Scot.* 1935 reprint 26 pp., 15 figs., 15 refs. Edinburgh, 1935.

The larvae of *Serica brunnea*, L., caused considerable damage to grass in Fifeshire by attacking the roots. A dressing of crude naphthalene (2 cwt. per acre) in autumn or spring is recommended. In recent

years the larvae of *Cladius difformis*, Panz., have defoliated rambler roses in Scotland during June, July and September. They can readily be destroyed by sprays of 8 oz. lead arsenate paste, 4–16 oz. hellebore powder, or 3 fl. oz. nicotine (98 per cent.) and 8 oz. soft soap, per 10 gals. water. In the summer of 1934 *Phyllotreta undulata*, Kutsch., severely injured turnips throughout the south of Scotland. Measures for the control of this and allied flea-beetles are briefly reviewed [*R.A.E.*, A **16** 617 ; **23** 221].

KANGAS (E.). *Lyctus planicollis* **Le Conte, varastotuholaisena Suomessa.** [*Lyctus planicollis*, a new Stock-destroyer in Finland.]—*Suom. Hyönteistiet. Aikakausk.* **1** no. 1 pp. 23–27, 1 fig., 7 refs. Helsinki, 1935. (With a Summary in English.)

Lyctus planicollis, Lec., was found, for the first time in Finland, in a warehouse in Helsinki where it had destroyed the ash handles of over 200 dozen spades that had been imported from England. The larvae had eaten most of the spring wood and left the summer wood so that the handles fell apart along the annual rings. As this Lyctid is a native of the southern United States, it had probably been introduced into England in imported timber [*cf. R.A.E.*, A **22** 544] and thence into Finland in the manufactured product. Other species of *Lyctus* occurring in timber in Finland are *L. linearis*, Gze., which is a native species and *L. brunneus*, Steph.

RAUCOURT (—). **Observations sur la toxicité des insecticides arsenicaux.**—*Rev. vét.* **87** pp. 591–597. Toulouse, October 1935.

The author discusses the danger to man, domestic animals, poultry, and bees of arsenic residues resulting from the spraying or dusting of trees or plants against insect pests [*cf. R.A.E.*, A **21** 398]. He concludes that there is no danger from the consumption of fruit (apples and pears) provided that treatments are carried out at the times specified by the French regulations [*cf.* **22** 511] ; if late treatments are authorised, the residues at the time of picking should be estimated and the fruit washed if necessary. Fowls may be used to destroy *Leptinotarsa decemlineata*, Say, without risk of their being poisoned by arsenic ingested by the beetles. The danger to bees may be minimised by avoiding the application of arsenical sprays at the time of flowering ; it is difficult to protect bees from arsenical dusts. The carriage of dusts by the wind is not likely to prove dangerous, although they should not be applied in the immediate vicinity of vegetable crops and human habitations.

MAYNÉ (R.). **L'apparition du Doryphore en Belgique.**—*Bull. Soc. ent. Belg.* **75** nos. 8–9 pp. 322–323, 339–340. Brussels, August & September 1935.

Leptinotarsa decemlineata, Say, was found for the first time in Belgium in 1935, when 2 adults were killed in a garden at Furnaux on 26th June, and some larvae were discovered on potato plants on 11th July. Two days later 107 second and third instar larvae were found on 15 plants within 120 sq. yds. All plants within a radius of about $1\frac{1}{4}$ miles were dusted with calcium arsenate or sprayed with lead arsenate. The plants on the site of the outbreak over an area of 180 sq. yds. were destroyed, and the soil was treated with a mixture of equal parts of kerosene and petrol at the rate of $8\frac{3}{4}$ pints per sq. yd., and then carefully

sifted. The transport of potatoes from any locality within a radius of 1¼ miles of the focus of infestation was forbidden. On 21st July a second infestation was reported from a village near the French frontier and by 13th August 12 more foci had been discovered. The 14 foci recorded, which were all situated in the south-west corner of Belgium near the French frontier, were each limited to a few plants close together and comprised larvae, pupae and adults. Probably the invasion was due to swarms that had flown northwards from France because of high temperatures and winds that occurred during June [*cf. R.A.E.*, A **23** 632].

SCHWARTZ (M.). **Der Kartoffelkäfer vor der deutschen Grenze ?** [The Potato Beetle at the German Frontier ?]—*NachrBl. dtsch. PflSchDienst* **15** no. 10 pp. 89–90. Berlin, October 1935.

Particulars are given of the occurrence of the Colorado potato beetle [*Leptinotarsa decemlineata*, Say] in Belgium [see preceding paper]. By 21st September 30 foci had been found, one being 30 miles from Germany. The beetles appear to have flown over from the French department of Aisne, passing over wooded hills up to about 1,000 ft. in altitude. The distribution of the beetle in parts of France near the German frontier is noted.

SCHÜTZE (K. T.). *Epiblema tedella* **Cl. und** *proximana* **Hw.**—*Ent. Z.* **48** no. 19 pp. 145–148. Frankfurt a.M., 8th January 1935.

There has been some doubt whether *Epiblema tedella*, Cl., occurs on fir [*Abies*] as well as on spruce or whether the Tortricid on fir is only *E. proximana*, H.-S. Observations by the author in Germany indicate that the former must be regarded as markedly associated with spruce and the latter with fir.

RIGGERT (E.). **Zur Kenntnis der Lebensgewohnheiten von** *Oscinella frit* **L. und ihrer Jugendstadien.** [The Biology of *O. frit.* and of its developmental stages.]—*Arb. physiol. angew. Ent.* **2** nos. 2–3 pp. 101–130, 145–156, 7 figs., 3 pp. refs. Berlin, 15th July & 20th September 1935.

Investigations on the biology of *Oscinella frit*, L., were made in Schleswig-Holstein to supplement published data. The differences between the pupae and those of *Crassiseta* (*Elachiptera*) *cornuta*, Fall., and between the eggs and those of *Hydrellia griseola*, Fall., which were observed on barley and oats, are described and figured. *O. frit* oviposited almost exclusively behind the ligula of the plant and never on the leaves as was the case with *H. griseola*.

In experiments the shortest time for incubation was 1½–2½ days, at 32°C. [89·6°F.], 14–15 days being required at an average of 11·5°C. [52·7°F.]. At North German average daily temperatures of 14–20°C. [57·2–68°F.], incubation in nature should require 4–9 days. Light and humidity were relatively unimportant ; the eggs developed even at as low a humidity as 75 per cent. The larvae, however, required great humidity for hatching. Even at 86 per cent. humidity, there was delay in breaking the shells and some of the embryos died. The first instar larvae usually did not mine, but moved over the leaf-surface to the

heart of the seedling. For lack of original observations on the effect of temperature on the feeding of the larvae, those made by Kreĭter are given [*R.A.E.*, A **19** 283]. As regards its effect on their development, it was found that at 12·5°C. [54·5°F.] they lived for over a month without pupating, and that they could not survive over 36°C. [96·8°F.]. The larval stage lasted 21 days at 15°C. [59°F.], 14–16 at 19°C. [66·2°F.], 13 at 21°C. [69·8°F.], 9–10 at 24°C. [75·2°F.], 8–10 at 25°C. [77°F.], 6–7 at 28°C. [82·4°F.], and 6–8 at 32°C. [89·6°F.]. Weather conditions other than temperature did not appear to have any influence. It is considered probable that *O. frit* hibernates only in the larval stage. Five out of ten mature larvae survived exposure for some days to 7·5–10°C. [45·5–50°F.] followed by 24 hours at −8·5°C. [16·7°F.]. Of 15 pupae 8 survived 24 hours at −8·5°C., but this stage did not seem able to resist prolonged exposure to winter cold. The critical temperature appeared to be under 12°C. [53·6°F.], perhaps at 7–8°C. [44·6–46·4°F.]. The pupal stage lasted 5–30 days.

Adult emergence began about half an hour after sunrise, reached its maximum about two hours later and was almost over by 10 a.m., so that daily maximum temperatures would not affect it. Emergence was favoured by moist air and hindered by dry air. The adults were able to fly at greater heights than usually believed and were quite numerous at 36 ft. above the ground. More were caught on an adhesive surface turned towards the wind than on one turned away from it. They fed on the flowers of a variety of plants. Fully mature eggs were found in the females in 6–9 days at temperatures that had sometimes fallen to 10°C. [50°F.] and had never exceeded 20°C. [68°F.]. At 25–30°C. [77–86°F.] the eggs were mature in 3–4 days. Females taken in the field contained an average of 18 eggs and a maximum of 24; captive females produced less eggs. Young, juicy tissues, and particularly cereal seedlings with 3 or 4 leaves, were preferred for oviposition. On ears the eggs were laid on the rachis and glumes. Oviposition often ended before the close of the flight period and did not seem to occur below 12°C. [53·6°F.]. Adult life lasted about a fortnight.

Schuch (K.). **Beobachtungen über die Biologie des Maikäfers.** [Observations on the Biology of *Melolontha melolontha* and *M. hippocastani*.]—*Arb. physiol. angew. Ent.* **2** no. 3 pp. 157–174, 1 fig. Berlin, 20th September 1935.

These observations were made in Schleswig-Holstein during supervision of systematic collection of adults of *Melolontha melolontha*, L., and *M. hippocastani*, F., in the flight-year 1934 [*R.A.E.*, A **23** 594].

Pupation took place at a depth of 9–14 ins., and on 26th April no adult was found at a greater distance than $3\frac{1}{4}$ ins. from the pupal case in the ground. The average number of beetles was about 4 per sq. yd. The first flight was on 27th April and the last on 28th June. Mating occurred within 24 hours of emergence from the ground and oviposition began on 8th May. *M. melolontha* was almost exclusively present during the chief flight period, but towards the end of it *M. hippocastani* increased considerably in some limited areas. In one case a male *M. melolontha* was observed pairing with a female *M. hippocastani*. Deciduous trees were the usual food-plants of the adults, larch and spruce were less attacked, and grass and clover only exceptionally. The beetles always collected on the leeward side of the tree, feeding

first at the tips of the branches. Ovipositing females were greatly attracted by meadows, clover fields, young plantations in forests and field borders. Newly cultivated soil was generally avoided, but winter and summer cereals were strongly infested. The females had not begun to oviposit 14 hours after they had burrowed into the ground, but had done so after 24 hours. They left the ground after 3–4 days. The eggs were laid 5–16 inches below the surface, the depth being greatest in loose soil. Indoors, incubation took 40 days, while eggs in the open had not hatched after 54. In certain conditions first-instar larvae proved injurious. Of 43 larvae collected in a meadow that was being ploughed 34 were parasitised by the Tachinid, *Dexia rustica*, F., up to 11 larvae of which were found in one host.

MAERCKS (H.). **Der Einfluss der Nahrung auf die Entwicklung der Nonnenraupe. (Untersuchungen über die Oekologie und Epidemiologie der Nonne, II.)** [The Influence of Food on the Development of the Nun Moth Larva. (Investigations on the Ecology and Epidemiology of the Nun Moth, II.)]—*Arb. physiol. angew. Ent.* **2** no. 3 pp. 175–195, 5 figs., 12 refs. Berlin, 20th September 1935.

In continuation of Janisch's work [*R.A.E.*, A **21** 378], the author made laboratory experiments on the effect of different food-plants on the development of larvae of *Lymantria monacha*, L.

The following is taken from his summary: At 14°C. [57·2°F.], 22°C. [71·6°F.] and 31°C. [87·8°F.] the larvae throve better on leaves of deciduous trees than on conifer needles, and on the latter their moults were considerably delayed. Of the deciduous trees, the most favourable were beech, hazel and apple, in the order given, and of the conifers pine, larch and spruce. On *Alnus incana*, development took even longer than on conifers and mortality was greater, only a small percentage of larvae reaching the fourth instar.

At 14 and 31°C., the first moult on pine occurred later than on larch, apparently because the first-instar larvae could not attack the hard pine needles so readily as the softer larch needles. Near the optimum temperature of 22°C., and also at 27°C. [80·6°F.] the shortest times for the first moult were the same with pine and larch.

REICHERT (A.). **Rosenschädlinge.** [Rose Pests.]—*Kranke Pflanze* **12** no. 9 pp. 137–139, 1 pl., 5 refs. Dresden, September 1935. **Insektenfeinde der Rosenschädlinge.** [Insect Enemies of Rose Pests.]—*T.c.* no. 10 pp. 158–160, 1 pl. October 1935.

The first article is the final one of a series on pests of roses in Germany [*cf. R.A.E.*, A **23** 506, etc.]. Larvae of the Tipulids, *Pachyrhina lineata*, Scop., *P. quadrifaria*, Mg., and *P. maculata*, Mg., and the Stratiomyiid, *Microchrysa polita*, L., have been observed injuring the root-collars of seedlings. They can be killed by heating the earth in which planting is to be done. The Buprestid, *Agrilus viridis*, L., has often been recorded as a serious pest of roses, but during 50 years in Saxony the author has seen it only on other plants, especially willows.

In the second article brief notes are given on some of the natural enemies of rose pests in Germany, including a Braconid, probably a species of *Meteorus*, bred by the author from *Eucosma* (*Notocelia*) *roborana*, Treit.

Pilat (M.). **The Effects of intestinal poisoning on the Blood of locusts** (*Locusta migratoria*).—*Bull. ent. Res.* **26** pt. 3 pp. 283–288, 2 pls., 10 refs. London, September 1935.

This work was undertaken to ascertain the effects of poison on the structure of the blood of insects and the applicability of microscopic examinations to the study of the action of intestinal poison on them. The method of preparing and fixing smears is described. Fifth stage hoppers and newly moulted adults of *Locusta migratoria*, L., were poisoned through the intestinal tube with 0·1 and 0·2 per cent. solutions of sodium arsenite or sodium fluosilicate. After a detailed description and discussion of the different types of haemocytes found in the haemolymph of normal and poisoned locusts, the author concludes that the pictures of these do not present any appreciable differences, and that until the precise and uniform principles of classification of the elements of the haemolymph of insects are established, it is impossible to give a numerical expression (haemogram) of the picture of the blood after poisoning.

Eig (A.). **Ecologie du Criquet marocain en Iraq.**—*Bull. ent. Res.* **26** pt. 3 pp. 293–314, 3 pls., 10 refs. London, September 1935.

The author studied the vegetation of Iraq in connection with the ecology of *Dociostaurus maroccanus*, Thnb. He divides that country into five phytogeographic subdivisions : the northern part of the great Arabian plateau, which with its Saharo-Sind flora, is entirely outside the invasion area of this locust ; the Iraqi part of the great Syrian desert, the Mesopotamian alluvial plain and the Iraqi Kurdistan, all of which can be invaded by swarms ; and finally the northern steppes of Iraq, containing the zone of optimum climatic conditions for the species. It is proposed to use the term reservation for those patches of this zone in which egg-laying occurs regularly even during the minimum years. In northern Iraq these were found to coincide with the association *Poa bulbosa, Carex stenophylla* and *Ranunculus asiaticus* (the latter forming an excellent indicator), which is the spring stage of the *Phlomis bruguieri* association. This is described in great detail ; it usually develops on rather compact, non-sandy and non-gypseous, well drained soil ; the vegetative period commences early in spring, and maximum development is reached at the time of hatching of the hoppers. When the breeding grounds are far from cultivated fields, the plants composing the summer stage of the *Phlomis bruguieri* association serve as food for the hoppers.

The author supports the recommendations for the study and control of this locust made by Uvarov [*cf. R.A.E.*, A **20** 548 ; **21** 627] and urges the need of further ecological study of the *Poa-Carex-Ranunculus* association.

Hanna (A. D.). **Fertility and Toleration of Low Temperature in** *Euchalcidia caryobori*, **Hanna (Hymenoptera, Chalcidinae).**—*Bull. ent. Res.* **26** pt. 3 pp. 315–322, 3 figs., 9 refs. London, September 1935.

To maintain a supply of *Euchalcidia caryobori*, Hanna, the Chalcid parasite of the Bruchid, *Pachymerus* (*Caryoborus*) *pallidus*, Ol., infesting senna pods [*R.A.E.*, A **22** 482], between September and May when consignments of senna arriving in London from the Sudan are not

infested to any extent, large numbers of parasitised and unparasitised pupae of the Bruchid were obtained by sifting them from the senna pods. The Chalcids soon emerged in glass jars at 27°C. [77°F.] and oviposited through the cocoons on the pupae of the Bruchid. They were fed on peeled sultanas, moistened daily and changed every 3 days. By keeping host pupae containing early stages of the parasite pupae at 15–23°C. [59–73·4°F.] the development of the latter was retarded for a considerable time. Adults soon emerged when these pupae were transferred to a temperature of 77°F. When kept continuously at 77°F. fertilised females of *E. caryobori* laid eggs producing equal numbers of the sexes, but females from pupae kept at the low temperature for 15 days, after being paired with males similarly treated, laid eggs that produced a preponderating proportion of males (132 : 18). Tests showed this to be due mainly to low temperature and not inbreeding, the temperature acting first on the males and later on the females. Thus the shorter exposures rendered the males sterile, so that most of the females were unfertilised and their eggs consequently produced males, whereas longer exposures (36–50 days) sterilised the females so that few or no eggs were laid.

Keeping last instar larvae at a low temperature for 55 days and then allowing them to complete development at 77°F. did not affect the fertility of the adults of either sex. As the average temperature during the winter in the region of Port Sudan, from which the senna was shipped, is 22°C. [71·6°F.], *E. caryobori* appears to escape the effect of low temperature by hibernating as a larva. Moreover some living larvae were collected from London Docks in February after surviving the English winter, though all the pupae and adults were dead.

Microscopic examinations were made of the internal reproductive organs of both sexes when reared at normal and at low temperatures, and the effect observed to be exerted upon the male and female organs respectively is described. The results of these experiments are compared with those secured by workers on other insects, which they appear to confirm.

MYERS (J. G.). **The ecological Distribution of some South American Grass and Sugar-cane Borers** (*Diatraea* **spp. Lep., Pyralidae**).—*Bull. ent. Res.* **26** pt. 3 pp. 335–342, 1 pl., 9 refs. London, September 1935.

The following is taken from the author's summary : The survey of *Diatraea* spp. in their primitive habitats [*cf. R.A.E.*, A **20** 547] has now been extended to cover the interior Guiana plateau, the Rio Branco, the lower Rio Negro and the lower Amazon. In the course of the survey *Metagonistylum minense*, Tns., the Dexiid parasite of *Diatraea saccharalis*, F., was discovered and introduced into British Guiana [**22** 566]. Several species of *Diatraea* were found as original members of a true savannah association. The 12 species considered are grouped as forest, riparian, savannah and domestic species. The two forest species are *D. bellifactella*, Dyar, and *D. brunnescens*, Box. Riparian grass associations are developed over huge areas on the lower Amazon, where they may be divided roughly into three main zones, dominated by *Paspalum repens*, *Echinochloa polystachya*, and *Paspalum fasciculatum* respectively. *D. saccharalis* is the only species of the first and second zones, where it is occasionally abundant, and the third zone is colonised by *D. amazonica*, Box, and *D. myersi*, Box. The pure

savannah species are *D. canella*, Hmps., *D. impersonatella*, Wlk., *D. savannarum*, Box, and *D. cayennella*, Dyar & Heinr. *D. lineolata*, Wlk., is practically confined to maize, and no wild food-plants either naturalised or indigenous are known. Sugar-cane is attacked by *D. saccharalis*, *D. busckella*, Dyar & Heinr., *D. impersonatella*, and *D. canella*, all of which are major pests over considerable areas, and by *D. albicrinella*, Box.

Miller (N. C. E.). **An improved Air-pump for Use in the Preservation of Larvae.**—*Bull. ent. Res.* **26** pt. 3 pp. 355–356, 1 fig. London, September 1935.

An air pump has been designed to replace the rubber double-bellows type of inflator used in preserving larvae, which has been found unsatisfactory in the tropics owing to its rapid deterioration. The pump, which is of metal, has a one-way inlet-valve near the base on one side and is connected on the other side, also near the base, to a metal cylinder having a well-fitted sliding jacket over it. The metal tube connecting the two cylinders has a one-way air inlet valve at the end farthest from the pump. Opposite this valve is a tube to which the glass tube that is inserted into the body of the larva is connected by a short length of rubber tubing. Both pump and cylinder are fixed to a base that can be screwed or clamped to a bench. When the pump is operated, the sliding jacket of the cylinder is forced upwards, and by its weight it maintains a steady pressure of air while the larval skin is being dried in the oven.

Ramakrishna Ayyar (T. V.). **A new Species of Thysanoptera from S. India** (*Taeniothrips cardamomi*, **sp. nov.**).—*Bull. ent. Res.* **26** pt. 3 pp. 357–358. London, September 1935.

Ramakrishna Ayyar (T. V.) & Kylasam (M. S.). **A new Disease of Cardamom** (*Elatteria cardamomi*) **apparently due to Insect Damage in South India.**—*T.c.* pp. 359–361, 1 pl., 3 refs.

Serious injury to the seed pods of *Elatteria cardamomi*, which spoiled the appearance of 50,000 lb. of dry cardamom fruit, was reported in the Anamalai Hills, South India, in December 1934. Investigation showed that the damage was associated with the feeding of *Taeniothrips cardamomi*, sp. n., the macropterous males and females of which are described in the first paper. The feeding injury, the symptoms of which are described in detail, caused discoloured patches on the skin of the pods, checked the development of the seeds, depriving them of aroma, and extended to the flower stalks, causing a considerable amount of shedding of pods and flowers. The damage was invariably inflicted at the early blossom stage, but persisted as a scab when the pod was fully developed. Concentrated feeding by a large number of thrips either caused the tissue to turn brown and die or develop a corky layer as the result of the irritation set up.

T. cardamomi occurred in numbers inside the bracts, perianth leaves, and unopened flowers, on the main peduncle and in the spindle of the top shoots. The nymphs, pre-pupae and pupae were found within the perianth round the ovary. The adults were sluggish and rarely took to flight. In normal years damage to pods does not exceed 7–10 per cent., but in 1934 it was about 90 per cent., 6–7 nymphs and 2–3 adults being commonly found round each ovary of a flower.

The continued drought since November 1932 appears to have been favourable to thrips in general. *T. cardamomi* continues to breed in the shoot until the appearance of the flowers, to which the thrips migrate. Little injury is observed in the first pickings, but as the warm weather sets in, the thrips population increases, and greater damage is found in the November and December pickings. The only alternative food-plant so far observed is *Panicum longipes*. An attempt has been made to control the thrips before they can enter the blossoms by spraying with nicotine or nicotine sulphate but the results are not yet known. Brief mention is made from the literature of other insect pests of cardamom in India.

SWEETMAN (H. L.). **Successful Examples of Biological Control of Pest Insects and Plants.**—*Bull. ent. Res.* **26** pt. 3 pp. 373–377. London, September 1935.

Successful examples, from which those of a temporary or local nature are excluded, of the biological control of noxious insects and plants are shown in three tables. These record the insect or plant concerned, the insect used against it, and the country in which the work was done. Two of the tables deal with insect pests, the first including cases in which the beneficial species has eliminated the necessity for other control measures, and the second those in which it is usually or largely adequate, but in which some damage, or even local outbreaks, may occur. The danger of concluding that the existence of high percentages of parasitism or predatism has in every case been responsible for the elimination of a pest when other factors have possibly been actually responsible is pointed out, and some general conclusions are drawn from the cases cited.

FERRIÈRE (C.). **The Chalcidoid Parasites of Lac-Insects.**—*Bull. ent. Res.* **26** pt. 3 pp. 391–406, 9 figs., 19 refs. London, September 1935.

Descriptions are given of the following Chalcidoid parasites associated with lac in India, together with records of some of them from other parts of tropical Asia : the Eupelmid, *Eupelmus tachardiae*, How., the Encyrtids, *Tachardiaephagus tachardiae*, How., with var. *somervilli*, Mahd., *Erencyrtus dewitzi*, Mahd., *Parechthrodryinus clavicornis*, Cam., and *Atropates* (*Microterys*) *hautefeuilli*, Mahd., the Aphelinids, *Coccophagus tschirchii*, Mahd., and *Marietta* (*Perissopterus*) *javensis*, How., and the Eulophid, *Tetrastichus purpureus*, Cam., parasitic on *Laccifer* (*Tachardia*) *lacca*, Kerr ; the Chalcid, *Brachymeria tachardiae*, Cam., on the predators, *Holcocera pulverea*, Meyr., and *Eublemma amabilis*, Moore ; *Elasmus claripennis*, Cam., on *E. amabilis* ; *Eurytoma pallidiscapus*, Cam., on *H. pulverea* ; and the Encyrtids, *Anicetus dodonia*, sp. n., and *Proleurocerus fulgoridis*, gen. et. sp. n., from unknown hosts. *P. fulgoridis* has probably no other relation with *L. lacca* than that of having been possibly bred on the same tree. The author does not consider *Perissopterus* generically distinct from *Marietta*.

A list is given of the Ichneumonid and Braconid parasites associated with lac, which have already been noticed [*R.A.E.*, A **14** 138 ; **17** 154 ; **20** 315 ; **23** 278], but of these *Microbracon* (*Bracon*) *tachardiae*, Cam., a parasite of *Eublemma*, is recorded as a synonym of *M.* (*B.*) *greeni*, Ashm.

Morris (K. R. S.) & Cameron (E.). **The Biology of *Microplectron fuscipennis*, Zett. (Chalcid.), a Parasite of the Pine Sawfly (*Diprion sertifer*, Geoff.).**—*Bull. ent. Res.* **26** pt. 3 pp. 407–418, 1 pl., 4 figs., 12 refs. London, September 1935.

An account is given of the biology, morphology of all stages and artificial rearing of the Eulophid, *Microplectron fuscipenne*, Zett., which was found in considerable abundance parasitising cocoons of *Diprion sertifer*, Geoff., in Austria, Hungary and Jugoslavia, and which readily attacked those of *D. polytomus* Htg., a spruce sawfly in Canada against which it is desired to introduce parasites. It appears to parasitise exclusively the genus *Diprion*, having been recorded from *D. pini*, L., *D. sertifer* and *D. pallidus*, Klug. Although mainly primary, it is apparently sometimes accidentally hyperparasitic on *Microcryptus basizonius*, Grav., another parasite of *D. sertifer*. In one infestation of *D. sertifer* in Hungary it was a primary parasite in 71 per cent. of its total parasitism and secondary in 29 per cent., but in Jugoslavia it was almost entirely primary. *Eupelmella vesicularis*, Retz., appears to be a hyperparasite of *M. fuscipenne*.

The wide geographical distribution of *M. fuscipenne* in Europe is discussed, together with the range of climatic conditions under which it is able to survive. Although it is numerous in many regions with a rigorous climate, it seems to reach maximum abundance in a warmer more southerly one. Thus it gave only 2–3 per cent. parasitism in Austria, 10–15 per cent. in Hungary, and 33–80 per cent. along the Adriatic coast of Jugoslavia, where the long and hot summer lengthens the breeding season and shortens the life-cycle. In localities of maximum abundance in Jugoslavia all available cocoons of *D. sertifer* had been parasitised, and the majority of the parasites had emerged, by the beginning of August, so that as there are no other hosts available and *D. sertifer* has only one generation a year, the Eulophid must suffer severe reduction in late summer and autumn. Only a small number of living larvae, which go into a diapause, remain until new host cocoons are available at the end of the following May. *D. sertifer* is maintained by a small proportion of cocoons that are in situations inaccessible to the parasite, usually because they are deeply buried in the soil. In Jugoslavia, almost all the cocoons are on the tree-trunks, and this large supply of accessible host material is the chief factor bringing about the rapid increase of the parasite in summer. Cocoons in the ground are seldom deeply hidden because of the scanty layer of pine needles and the hard rocky soil.

In Hungary, in a locality where the summer is equally long and warm, though drier, and the winter much colder, infestations were sporadic, as the cocoons are mostly buried beneath 1–2 inches of pine needles. Here, although the host cocoons lie from May to September, as in Jugoslavia, maximum parasitism reached in August was only 10 per cent. Studies at Isak, Hungary, showed that under field conditions during July, with a temperature of 23°C. [72·4°F.] and relative humidity of 80 per cent., the life-cycle of *Microplectron* lasted 15–18 days. Under laboratory conditions at 21°C. [69·8°F.] and 70 per cent. humidity it averaged 21–23 days. There is apparently time for 4 complete generations to develop between May and September in this locality, where the mean temperature remains at 21°C. [69·8°F.] during the latter month, though owing to overlapping it is not certain whether there are as many in the field. Some families do not go through

more than 2–3 generations, a large proportion of full-grown larvae going into diapause in August and practically 80 per cent. by the beginning of September. In Jugoslavia, up to 5 generations a year might be expected. In Austria there were only 2, the second going into hibernation as pre-pupae early in August.

Adults of *M. fuscipenne* lived 10–14 days in the laboratory. Females are greatly in excess of males both in the field and laboratory, being 6 times as numerous in Hungary and 4 in Jugoslavia. Pairing takes place immediately after emergence. Oviposition is effected through the host cocoon, on the pre-pupa, up to 20 or more eggs being laid on each by one female. Several females sometimes oviposit on one cocoon. Individual females laid an average of 45 eggs each with a maximum of 124. Unmated females oviposited freely but the offspring were males. From 5 to 119 individuals emerged from naturally parasitised cocoons. The eggs hatch in 2–3 days at 22°C. [72·4°F.] and 70 per cent. humidity. There are 5 larval instars, each of the first four lasting 1 day. The fifth instar larva feeds for 4 days and remains quiescent for 2–3 days ; then the pre-pupal stage lasts 24–30 hours and the pupal 7–8 days.

Tests in which *M. fuscipenne* was successfully reared in the laboratory on cocoons of *D. polytomus* from Canada are described. Cocoons of *D. sertifer* containing nearly eight millions of the parasite were collected and despatched to Canada during 1934. Although this Eulophid has never been found parasitising *D. polytomus* in Europe, where the geographical range of both species is the same, this is probably due to lack of abundance and regularity of appearance of the host. Both these conditions are present in Canada, and the parasite was recovered in 1935 from the cocoons of *D. polytomus* in at least 3 localities where liberations were made in the previous summer. In Canada many of the pre-pupae of *D. polytomus* remain in diapause for one or two years, thus ensuring an ample supply of cocoons throughout the summer ; most of the cocoons are spun on the forest floor, but where the needle layer is thin, or where cocoons occur upon the trunks or branches, as in some warmer localities, the Eulophid will have full scope for its activities. As the females lay 50–100 eggs in 6–7 days and all usually develop, mass-production of this parasite is comparatively simple.

Otero (A. R.). **Insectos del guayabo en Cuba.** [Guava Insects in Cuba.]—*Circ. Estac. exp. agron. Cuba* no. 78, 26 pp., 4 figs., 9 refs. Santiago de las Vegas, May 1935. [Recd. October 1935.]

Guava grows vigorously in Cuba and is not subject to a really destructive attack by any pest, so that little attention has been paid to the insects infesting it. The author has, however, found it to be attacked by a number of insects and gives notes on them, together with records of those observed by others. The more injurious include *Anastrepha acidusa*, Wlk., probably the most important pest ; *Coccus viridis*, Green, of which the chief natural enemy is the fungus, *Cephalosporium lecanii* ; *Aleurodicus cardini*, Back, parasitised by an Aphelinid, probably *Encarsia* sp., and attacked by *Baccha parvicornis*, Lw., *B. clavata*, F., and other predators ; *Chilocampyla psidiella*, Busck, a common leaf-miner that has several parasites, including the Braconid, *Mesocoelus laeviceps*, Ashm. ; *Nystalea nyseus*, Cram., which sometimes skeletonises the leaves on entire branches and is parasitised by the Braconid, *Apanteles herberti*, Ashm. ; *Attelabus aureolus*

Gyll., parasitised by a Chalcid, *Zatropis* sp.; *Eucosma* (*Strepsicrates*) *smithiana*, Wlsm., which is common, but not very harmful and is parasitised by a Eulophid, *Elachertus* sp.; *Amorbia phaseolana*, Busck; and *Platynota rostrana*, Wlk., which is parasitised by the Braconids, *Apanteles balthazari*, Ashm., *Apanteles* sp. and *Chelonus* sp., and a Eulophid, *Sympiesis* sp.

BRUNER (S. C.). **La maruca y otros insectos de las habas de Lima.** [*Maruca testulalis* and other Insects of Lima Beans.]—*Bol. Estac. exp. agron. Cuba* no. 56, 52 pp., 6 pls., 11 refs. Santiago de las Vegas, June 1935. [Recd. October 1935.]

The information given in this paper on the Pyralid, *Maruca testulalis*, Geyer, and other pests of lima beans (*Phaseolus lunatus*) in Cuba is similar to that already noticed [*R.A.E.*, A **19** 569]. Additional parasites of *Maruca* are a Chalcid, *Brachymeria ovata*, Say, a Tachinid, *Nemorilla floralis*, Fall., and a Nematode, *Hexamermis* sp. A cheesecloth cover appears to benefit the plants while preventing attack by pests.

WILLE (J.). **Acción de las temperaturas bajas sobre las moscas de la fruta del género *Anastrepha*, que atacan los frutos en el Perú.** [The Action of low Temperatures on Fruit-flies of the Genus *Anastrepha* attacking Fruits in Peru.]—*Inf. Estac. exp. agric. Minist. Fom. [Peru]* no. 30, pp. 3–12, 1 graph, 10 refs. Lima, April 1935. [Recd. October 1935.]

A brief survey is given of published information on the application of low temperatures for killing *Ceratitis capitata*, Wied., in fruit [*R.A.E.*, A **23** 24, etc.].

The author has made experiments to test the effect of low temperatures on the fruit-flies harmful in Peru, which in his opinion are solely *Anastrepha fraterculus*, Wied., and its varieties. Eggs and larvae (in fruits) and pupae and adults were exposed to a temperature maintained between —1·6 and 0°C. [29·12–32°F.] in a chamber of 15 cu. ft. capacity. The relative humidity varied from 72 to 88 per cent.

The results are tabulated. A mortality of 100 per cent. was obtained by exposing the eggs for 4 days, the larvae for 7, the pupae for 8, and the adults for 3. *A. fraterculus* is therefore less resistant than *C. capitata*. Peaches and chirimoyas [*Anona cherimolia*] were injured to an extent that ruled out the application of low temperature to them. Apples and quinces were not much harmed and mangos and oranges were unaffected. Ripe grapes (which are not infested by *A. fraterculus* in Peru) were not harmed, gaining in flavour and sugar content after exposure to the cold for 15 days. It is concluded that exposure for 15 days to temperatures between —1·6 and 0°C. would ensure the destruction of all stages of *A. fraterculus* both inside and outside the fruits, and that many fruits, especially grapes, mangos and oranges, do not suffer in any way.

DE OLIVEIRA FILHO (M. L.). **Combate á saúva.** [Work against Leaf-cutting Ants.]—*Bol. Agric. S. Paulo* **35** (1934) pp. 541–610, illus. S. Paulo, 1935.

This compilation of data from various papers is designed to give a popular but comprehensive account of the bionomics of leaf-cutting

ants [particularly *Atta sexdens*, L.] in Brazil and of work of fumigating their nests officially organised by the author. The portable apparatus and its use are described. The fumigant is a mixture of 4 parts sulphur and 1 part arsenic and is not so much intended to kill the ants as to destroy the fungi that are their sole food.

After the flight, the females shed their wings, and each excavates a brood chamber where it starts the culture of the fungus before ovipositing. The females live for 4 or 5 years and oviposit continually, and a nest may remain in one place for 20 or more years, especially in the absence of armadillos, which are the chief natural enemies.

CORDEIRO LEITE (A.). **Multiplicação da vespa de Uganda.** [The Multiplication of *Prorops nasuta*, the Uganda Parasite.]—*Bol. Agric S. Paulo* **35** (1934) pp. 648–654, 4 figs. S. Paulo, 1935.

Details are given of the shed used in Brazil to activate the emergence of the Bethylid parasite [*Prorops nasuta*, Wtstn.] from coffee berries infested with *Stephanoderes hampei*, Ferr. [*cf. R.A.E.*, A **22** 186]. It is about 5 ft. wide, 8 ft. long and 6 ft. 6 in. high, and is exposed to the sun. On the hottest side the wall consists partly of a galvanised iron plate about 3 ft. high by 6 ft. long, serving to increase the heat inside. On the opposite wall are 2 windows ($1 \times 2\frac{1}{2}$ ft.) covered with wire gauze preventing the escape of the parasite. On the east wall there is a similar window and the door of galvánised iron. The window on the west wall is glazed, so that the parasites are attracted by the light. Open bags of coffee are placed inside, and when the parasites assemble at the glazed window, they are collected in a shallow box that is placed over the window and contains coffee berries infested with the borer. When the box is removed to a cool place, the parasites enter the berries. These are then placed in open tins in a group of 4 or 5 coffee bushes that have been left unharvested in each plot of 5,000–8,000.

EIDMANN (H.). **Zur Kenntnis der Blattschneiderameise *Atta sexdens* L., insbesondere ihrer Oekologie.** [A Contribution to the Knowledge of the Leaf-cutting Ant, *A. sexdens*, particularly of its Ecology.]—*Z. angew. Ent.* **22** nos. 2–3 pp. 185–241, 385–436, 45 figs., 3 pp. refs. Berlin, July & September 1935.

This paper records observations on *Atta sexdens* L., made in September and October 1933 in the State of Rio de Janeiro. Emphasis is placed on the high degree of specialisation of ants of this genus in their nest construction and in their independence of natural food through their cultivation of fungi. A description is given of the district visited, and chapters are devoted to the geographical distribution of the various species of *Atta* ; the egg, larva and pupa of *A. sexdens* ; polymorphism and division of labour ; the nest in all its parts ; food ; reproduction ; various aspects of behaviour ; and an investigation of some of the causes of variation in abundance.

The fungus cultivated by *A. sexdens* requires an exact study, one reason being that it may be more profitable to combat the ant indirectly by destroying the fungus. In the nests only the vegetative form is

present ; the ants bite off the aerial mycelia, so that conidia are not formed. In the vegetative form it resembles in almost every detail the fungus (*Rozites gongylophora*) bred by *Acromyrmex disciger*, Mayr.

The vital zone for *A. sexdens* lies on an average between 12 and 40°C. [53·6 and 104°F.], with slight variation between the castes. The temperature of the fungus chambers is 25°C. [77°F.] or about midway between the two extremes and would seem to be the vital optimum. All castes are very sensitive to the extreme temperatures. In the regions where *A. sexdens* is a pest, its population density is very high, and in the district visited by the author the territories ot the various nests overlapped. The ecological bases underlying the occurrence of *A. sexdens* are improved by agricultural practices, and this ant definitely follows cultivation. As a rule the reproductive capacity of *A. sexdens* balances the environmental resistance. The first critical period, which influences egg mortality, occurs when the females swarm and then burrow, for they are exposed to many natural enemies at that period. A second critical period, in which again biotic factors are concerned, occurs when the new nests are being founded, for they are likely to be destroyed by vertebrate and insect enemies. These factors lose their importance as the nest becomes older and extends to greater depths in the ground. The destruction of new nests seems ineffective as a means of reducing the density of population, and measures must be directed against the old ones.

Gösswald (K.). **Physiologische Untersuchungen über die Einwirkung ökologischer Faktoren, besonders Temperatur und Luftfeuchtigkeit, auf die Entwicklung von *Diprion* (*Lophyrus*) *pini* L. zur Feststellung der Ursachen des Massenwechsels.** [Physiological Investigations on the Action of ecological Factors, especially Temperature and Air Humidity, on the Development of *D. pini*, for determining the Causes of Variation in Abundance.]—*Z. angew. Ent.* **22** no. 3 pp. 331–384, 7 figs., 3 pp. refs. Berlin, September 1935.

In Germany, pine stands, particularly young ones, are sometimes defoliated by the sawfly, *Diprion pini*, L. An investigation of the causes of the marked variations that occur in its abundance was made at Munich, starting with larvae collected in July 1933. Low temperatures (about 10°C. [50°F.]) caused the larvae to turn black. Exposure to higher temperatures restored the original hue, but this power of reaction was impaired by prolonged starvation. The greatest larval weight was observed at 27°C. [80·6°F.]. Pupation occurred in the needles at high temperatures and in the ground at 14 and 12°C. [57·2 and 53·6°F]. With increasing humidity the cocoons became increasingly brown in colour.

The eggs were laid either in developed young needles or in needles one, two or three years old, and were cemented in. At all temperatures a high humidity favoured their development. At 100 per cent. humidity, all hatched between 24 and 14°C. [75·2 and 57·2°F.], 80 per cent. at 10°C. and 90 per cent. at 32°C. [89·6°F.]. Moulds due to high humidity did not hamper development. At 90 per cent. humidity, 80 per cent. hatched at 10°C. and 32°C. and 100 per cent. at 24–14°C. At 80 per cent. humidity, 90–100 per cent. hatched between 24 and 14°C., 60 per cent. at 10°C., and 50 per cent. at 27°C., but needles and eggs were withered at 32°C. At 55 per cent. humidity, 50 per cent.

hatched at 16°C. [60·8°F.]. The duration of development of the egg varied from 40 days at 10°C. to 7 at 32°C.

The larvae of *D. pini* were able to resist very high temperatures and very low humidities. They were particularly resistant to low humidity at high temperatures and high humidity at low temperatures, and were more susceptible to opposite conditions. This is contrary to some extent to what obtains with Lepidoptera from the same biotope. The lowest larval mortality was at 17°C. [62·6°F.] and 90–40 per cent humidity. The shortest duration (25 days) of larval development occurred between 26 and 32°C. [78·8 and 89·6°F.]. Alternating temperatures increased mortality as compared with constant temperatures, particularly in the younger larvae. This greater sensitiveness was most marked if there was another unfavourable factor, such as renewal of food every two days instead of daily.

The stages in the cocoon were almost insensitive to differences in humidity at all temperatures, owing to the protection of the tough envelope. The temperature permitting the largest number of adults to emerge was 16°C. [60·8°F.], which is above the average temperature in the countryside. Adult emergence had two peaks, the second being usually twice as large as the first. Females were three times as numerous as males. There was one annual generation in the neighbourhood of Munich, and no experimental treatment succeeded in producing a second. In warm regions two generations seem to predominate.

These experiments show *D. pini* to be to some extent independent of external factors, and it has a very wide distribution. An especially great increase will be promoted by dry weather with temperatures between 20 and 26°C. [68 and 78·8°F.]. A favourable distribution of warmth is necessary to render possible emergence of the parent generation at the right time, simultaneous emergence of the sexes, etc. As regards control, an arsenical dust may be used against the young larvae, and the author has also found one containing pyrethrum to be very effective [*R.A.E.*, A **21** 435].

SCHMALFUSS (H.). **Empfindlichkeit der Blattschneideameise,** *Atta sexdens* **L., gegen Giftgase.** [The Sensitivity of the Leaf-cutting Ant, *A. sexdens*, to poisonous Gases.]—*Z. angew. Ent.* **22** no. 3 pp. 437–451, 3 figs. Berlin, September 1935.

In connection with investigations bearing on the control of the leaf-cutting ant, *Atta sexdens*, L., in Brazil [*cf. R.A.E.*, A **23** 663, 750], the author made bottle experiments with various inorganic and organic poisonous gases, including carbon bisulphide and ethylene dichloride. The results are recorded in detail in tables. Of all the gases tested three inorganic poisons, hydrocyanic acid gas, hydrogen sulphide (from $Al_2S_3+H_2O$) and nitrogen dioxide (from $NaNO_3+38\%HCl$), proved the most effective. They killed all the ants in 30 minutes or less. The results indicated that simple compounds such as arsine (arsenic hydride) phosgene, hydrogen phosphide, etc., are promising, but not complicated compounds of carbon. The action of the poisons was not influenced by either light or shade, but increased with temperature (between 18 and 35°C. [64·4 and 95°F.]). In general the susceptibility to poison gases of the different castes of the ant decreased with increasing size.

Kozhanchikov (I. V.). **Zur Frage nach dem Temperaturoptimum des Lebens. V. Ueber die Beziehung der Entwicklungsgeschwindigkeit zum vitalen Optimum bei Insekten.** [The Question of the Vital Optimum Temperature. V. The Relation in Insects of the Speed of Development to the Vital Optimum.]—*Z. angew. Ent.* **22** no. 3 pp. 452–462, 13 refs. Berlin, September 1935.

The relation between the vital optimum temperature and that at which development was most rapid was investigated with *Loxostege sticticalis*, L., fed on *Chenopodium album*, and *Euxoa* (*Agrotis*) *segetum*, Schiff., fed on *Aegopodium podagraria*. The constant temperature at which the entire development of *L. sticticalis* was shortest was 30°C. [86°F.], and this was also the temperature at which the lowest preimaginal mortality (53 per cent.) occurred. When the stages were tested separately, however, the temperatures for shortest development and lowest mortality were the same in the case of the larval stage only, the temperature in question being 32·7°C. [90·86°F.]. In all developmental stages of *E. segetum* there was a difference between the temperature for shortest development and that for lowest mortality. In both species the period of greatest eurythermy occurred during the middle and last larval instars. The early larval instars of both species and the egg of *L. sticticalis* may be regarded as stenothermic. A given species can therefore be stenothermic or eurythermic in different stages.

The temperatures at which lowest mortality and greatest speed of development occur are tabulated for these and several other insects, either for the entire cycle or for one or more stages. In some cases the temperatures for vital optimum and development speed were the same ; in the others that for development speed was higher, the difference between it and that for vital optimum being termed the temperature interval. The data show that *Panolis flammea*, Schiff., *Lymantria monacha*, L., *Pieris brassicae*, L., and *E. segetum* have a very marked temperature interval in nearly all developmental stages. All these Lepidoptera are limited to the northern or temperate zone. The temperature interval is altogether absent in the larval stages of *L. sticticalis* and *Locusta migratoria*, L., and (according to Janisch) in all the stages of *Prodenia litura*, F. (*littoralis*, Boisd.). These insects occur in more southern and hotter regions, and the coincidence of temperatures for vital optimum and speed of development in them can be regarded as the result of an adaptation to temperature. The temperature interval can serve as a measure of the thermophily of a species. A species in which this interval is small in all stages of development will be characterised by sudden, short outbreaks. In the case of species with a considerable interval a period of preparation must precede an outbreak.

Eckstein (F.). **Zur Kenntnis des Rübenrüsselkäfers** (*Bothynoderes punctiventris* **Germ.) in der Türkei.** [The Beet Weevil, *B. punctiventris*, in Turkey.]—*Z. angew. Ent.* **22** no. 3 pp. 463–507, 19 figs., 30 refs. Berlin, September 1935.

Sugar-beet is an important crop in Anatolia, and its cultivation is increasing. The topographical and climatic conditions and the beet pests of the Ushak region are recorded [*cf. R.A.E.*, A **22** 561]. The importance of *Bothynoderes punctiventris*, Germ., led to the establishment of an entomological station to deal with all beet insects.

The author's observations on this weevil are noted in detail and compared with those in the literature. The adults left their winter quarters between early April and early May, apparently when the soil temperature reached a minimum of 9–10°C. [48·2–50°F.]. Voracious maturation feeding ensued, the development of the ovaries usually requiring at least 3 weeks and depending on food and weather. Two weevils were capable of defoliating the plants on a square yard. Both sexes fed prior to mating, which was soon followed by the death of the males. The first eggs were observed from early May onwards, the date depending on the weather. The weevils were not very active at temperatures below 17°C. [62·6°F.]. They laid 70–80 eggs each in daily batches of 3–5 at a depth of about 1–1½ ins. in the ground. The larvae hatched in 3 days and matured in about 6 weeks. The first pupae were observed on 29th July. The young adults developed about 3 weeks after pupation, but all remained in the ground until the following spring in spite of having developed to the adult stage at different dates. They hibernated at depths from 8 to 24 ins., and of those found only a few were dead or infected with fungi. Injury by the adults was serious, because the seedlings were stripped of their leaves and feeding extended over a long period. Larval feeding on the roots reduced their weight and sugar-content.

Various methods of control are reviewed and discussed. None is quite satisfactory, and barium chloride, in particular, has been overrated. The constitution of the soil is of secondary importance as regards the occurrence of *B. punctiventris*, its abundance and the injury it does being dependent on the rainfall in April and May. Its wide distribution shows it to be especially eurythermic. From the data obtained it is possible, in the case of regions with an annual rainfall under 20 ins., to recognise in advance, from the rainfall in April and May, the districts where *B. punctiventris* can become a serious pest, and to avoid them when introducing sugar-beet. From 1929 to 1932 the approximate average rainfall in April and May was 2½ in. in Eskishehir, 4 in Ushak, and 5 in Afion Karahissar. The danger is great in the first district, less in the second and still less in the third. No permanent injury occurs in Sincanli, with a rainfall of 12 ins.

Pieri (A.). **Lotta invernale contro gli afidi del pesco.** [Winter Measures against Aphids infesting Peach.]—*Note Fruttic.* **13** nos. 9–10 pp. 145–148, 161–164. Pistoia, September–October 1935.

The chief Aphids infesting peach in Italy are *Anuraphis schwartzi*, Börner (*persicae*, Boy.), *A. persicae-niger*, Smith, and *Hyalopterus arundinis*, F. (*pruni*, F.), which last is the most prolific and dangerous. The author found that infestation in 1935 was much reduced as compared with that in 1934 by one application early in January of a proprietary tar distillate, which caused no injury to the flower buds. Further experiments are necessary to obtain exact data on the value of such treatment, which it would be safer to apply in November or December.

B[oselli] (F. B.). **La mosca delle frutta** (*Ceratitis capitata* **Wiedm.**). [The Fruit-fly *C. capitata*.]—*Picentino* **90** no. 3–4 pp. 81–87. Salerno, 1934. [Recd. October 1935.]

In the summer and autumn of 1933, conditions were very favourable to *Ceratitis capitata*, Wied., in the province of Salerno and in South

Italy generally, and it was unusually injurious to peaches and *Citrus*. The measure advised was the use of trap-jars baited with water in which bran had fermented or with a 20 per cent. solution of wine vinegar. The work done by Bua with various baits is noticed [*R.A.E.*, A **22** 273; *cf.* also **23** 231].

Boselli (F. B.). **Ingenti danni del** *Tetranychus telarius* **o "acaro rosso" ai pomodori.** [Serious Injury to Tomato by *T. telarius*.]—*Picentino* **91** no. 5–6 pp. 153–154. Salerno, 1935.

In the province of Salerno serious injury to tomato plants, which resulted in the yellowing of terminal leaves, defoliation of basal leaves and general withering, has been caused by *Tetranychus telarius*, L. Pumpkins are also attacked. A sulphur dust or a 4–5 per cent. lime-sulphur spray should be applied when infestation begins in June. Apart from its cost, a mixture of nicotine sulphate and sulphur would be useful, especially when Aphids are present as well.

Subklew (W.). **Grundsätzliches zur Kornkäferbekämpfung, insbesondere zur Frage der Silobegasung.** [Basic Principles relating to the Control of *Calandra granaria*, especially on the Question of Fumigation in Silos.]—*Nachr. SchädlBekämpf.* **10** no. 3 pp. 101–107, 7 figs. Leverkusen, September 1935. (With Summaries in English, French and Spanish.)

After discussing the principles underlying the control of the grain weevil [*Calandra granaria*, L.], the author gives an account of the method of using Areginal to fumigate grain infested by it in silos in Germany [*cf. R.A.E.*, A **21** 127; **23** 298].

Listo (J.). **Eräitä kokeita herukan äkämapunkin torjumiseksi.** [Some Experiments for the Control of Black Currant Gall Mite (*Eriophyes ribis*, Nal.)]—*Maataloust. Aikakausk.* **7** no. 2 pp. 85–101, 1 fig. 10 refs. Helsinki, 1935. (With a Summary in English.)

Between 1923 and 1934 numerous reports were received of *Eriophyes ribis*, Nal., on black currants in Finland [*cf. R.A.E.*, A **14** 308]. Except for some parts on the east, the infested area covers almost the whole of south and central Finland, including the Karelian Isthmus. The mite is also found on the mountain currant (*Ribes alpinum*) and red currants. Hand-picking the "big" buds and cutting-off badly infested branches was practised without success. During 1931–33, experiments were carried out in two localities in south Finland to find whether spraying with lime-sulphur [**14** 52] would be effective. A commercial lime-sulphur diluted with water (1 : 6·5 or 1 : 7) to give a specific gravity of 1·025 was used and compared with other materials. The treatments were applied before the bushes flowered, the earlier ones usually when the flower buds appeared and the later ones just before the flowers opened. The numbers of healthy and "big" buds on 10 branches of each bush were counted each spring and compared with those obtained in the preceding year. Two applications of lime-sulphur made on 15th and 27th May gave the best results and reduced the infestation by 99·5 per cent. One application made when the flower buds began to appear was more effective than one made later, the earlier spray reducing the percentage of infested buds by from

89·6 to 97·9 (in the three years and the two localities) and the later one by from 32·6 to 89·3. A sulphur dust and a German proprietary spray (5 per cent. Solbar) were much less effective.

Wiesmann (R.). **Ergebnisse dreijähriger Untersuchungen über die Biologie und Bekämpfung der Kirschfliege** *Rhagoletis cerasi* **L. in der Schweiz.** [The Results of Three Years' Investigations on the Biology and Control of the Cherry Fly, *R. cerasi*, in Switzerland.]—*Anz. Schädlingsk.* **11** nos. 9–10 pp. 97–103, 110–115, 3 figs., 11 refs. Berlin, September–October 1935.

This is an account of investigations on *Rhagoletis cerasi* L., infesting cherries in Switzerland. The work done in 1932 and 1933 has already been noticed [*R.A.E.*, A **21** 681 ; **22** 433]. It was found that the effectiveness of paradichlorobenzene against the emerging adults [**22** 433] depended largely on rainy weather in spring, for in 1934 the results were less satisfactory than in 1933 when there was much rain. The isolated group of trees under which the soil was treated with a tar distillate spray against the pupae [*loc. cit.*] remained very slightly infested in 1934, proving that the effect of this treatment lasted at least two years ; further tests on a large scale are being made. As the pupae occur in the ground from August to May, the application can be made at any time during that period.

In Switzerland the question of food-plants other than cherry is not so important as in Germany, for the chief of these, *Lonicera xylosteum* and *L. tartarica* [**22** 247 ; etc.] are rare and were not infested in 1932–34.

Zwölfer (W.). **Der Waldmistkäfer,** *Geotrupes silvaticus* **Panz., als Steinpilzschädling.** [*G. stercorosus* as a Pest of the edible Mushroom, *Boletus edulis*.]—*Anz. Schädlingsk.* **11** no. 10 pp. 109–110, 1 fig., 7 refs. Berlin, October 1935.

Geotrupes stercorosus, Scriba (*sylvaticus*, Panz.) was observed in August 1934 attacking the stems and caps of young, healthy mushrooms (*Boletus edulis*) in South Germany, about 10 per cent. of the mushrooms gathered proving unfit for consumption. According to local reports similar injury had occurred in previous years.

Jacoby (M.). **Ueber den Nestbau der Blattschneiderameise** *Atta sexdens* **L.** [On the Nest Construction of the Leaf-cutting Ant, *A. sexdens*.]—*Anz. Schädlingsk.* **11** no. 10 pp. 115–117, 2 figs. Berlin, October 1935.

An account is given of observations on the internal structure of the nest of *Atta sexdens*, L., in Brazil, made in connection with investigation on its biology and control [*R.A.E.*, A **23** 752, etc.].

List (G. M.). **The Gladiolus Thrips in Colorado.**—*Circ. Colo. Ent.* no. 64, 15 pp., 6 figs., 7 refs. Fort Collins, Colo., February 1935. [Recd. October 1935.]

Taeniothrips simplex, Morison (*gladioli*, Mlt. & Stnw.) was first observed in Colorado in 1933 and in 1934 spread over a wide area and caused serious injury to commercially grown *Gladiolus*. A brief

account is given of its bionomics, based chiefly on the literature [*cf.* *R.A.E.*, A **20** 420, 699 ; **21** 464, 479] and partly on the author's own limited observations, and all stages are described. In Colorado it apparently cannot hibernate outdoors. Observations in 1934 indicated that there was a considerable migration from early to later blooming varieties, and in many cases from one garden to another. The control measures reviewed are : the removal of tops from corms at harvesting [**23** 4] ; keeping the stored corms at as low a temperature as possible ; fumigating them with naphthalene flakes [**21** 256] or calcium cyanide [**21** 465] ; immersing them in mercury bichloride (1 oz. to 7½ U.S. gals. water) for 4 hours if peeled, or for 8–12 hours if the husks have not been stripped [but *cf.* **23** 284] ; immersing them in semesan solution [**21** 464], or in hot water just before planting [**21** 479] ; and controlling the thrips in the field by a spray of Paris green with either brown sugar or a cheap molasses [**23** 2, 284].

Newton (J. H.). **Codling-Moth Control Experiments of 1934.**—*Circ. Colo. Ent.* no. 65, 23 pp., 6 figs. Fort Collins, Colo., March 1935. [Recd. October 1935.]

An account is given of spraying experiments against the codling moth [*Cydia pomonella*, L.] on apples in Colorado in 1934. In that year the moths emerged abnormally early in spring, there was a late summer flight, and the population was unusually large, the season being hot and dry. This necessitated a spraying schedule of two more cover sprays than usual for the district. It consisted of the calyx spray, 3 cover sprays each for the first and second broods and 1 for the partial third brood. The cover sprays afford the best protection if the cover is uniform, and this is attained by the use of spreaders. Calcium caseinate was the spreader used in the tests. As an excessive amount causes the spray to run off the fruit, the minimum required to produce an adequate film should be used. The lead arsenate selected for the spray had casein incorporated with it ; this could be transformed into calcium caseinate by the addition of hydrated lime, so that the amount of spreader could be controlled by varying the amount of lime. The amount of spreader required depends upon the hardness of the water and the fruit surface, and must be decided for each individual case. The lime is best mixed in a pail as it is then brought in close association with the casein so that the amount of it required is small and it does not dilute the lead arsenate. Coverage obtained when the materials had been mixed in a pail was superior to that obtained when the tank-mix method was used, apparently owing to the recent formation of calcium caseinate, or to its formation in close association with lead arsenate. The methods used in applying the sprays are described, and the results are shown for 3 varieties of apple and discussed. In lead-arsenate film-coverage plots of one variety, 79–81 per cent. of the fruit was free from all blemishes due to *C. pomonella*, only 2·7 per cent. being infested. The addition of 1 per cent. summer oil emulsion to lead arsenate reduced the percentage of blemishes, but the improvement obtained by the addition of nicotine sulphate did not justify the expenditure. Cryolite (sodium fluoaluminate), when used in the cover sprays, gave control equal or in some cases superior to that obtained with lead arsenate.

Samples of arsenical deposits were taken before and after the second and subsequent cover sprays by cutting disks from the skin surfaces of apples. Factors influencing the maintenance of coverage and deposit

include weather, rate of fruit growth and varietal characteristics, as well as character of material and thoroughness of application. It has been suggested that 0·08 mg. of arsenic per square inch of fruit surface is necessary for protection under conditions of heavy infestation. The control obtained on one variety was not so good as that obtained on the other, probably owing to a corresponding difference in deposit. Although spot coverage on both varieties showed a slightly higher deposit than film coverage, the latter gave better control.

A comparison of the deposit of lead and arsenic at harvest and residues after washing shows that film coverage is more effectively removed by acid wash than spot coverage, that oil in the spray makes lead arsenate more difficult to remove, and that acid wash cannot be depended upon to remove fluorine (cryolite) spray deposits. A detailed analysis is given of the costs of spraying operations in the experimental orchard.

Campbell (R. E.) & Elmore (J. C.). **The Tomato Pinworm.**—*Bull. Dep. Agric. Calif.* **24** pp. 301–309, 8 figs., 11 refs. Sacramento, Calif., 1935.

The history, distribution in the United States and economic importance of *Phthorimaea* (*Gnorimoschema*) *lycopersicella*, Busck, which is a serious pest of tomatos, are briefly reviewed from the literature [*cf. R.A.E.*, A **23** 277; **20** 607; **19** 654; etc.]. In California no fruit was picked at all in several heavily infested fields during 1934. Although in numbers of fields the actual damage was slight, the fruit did not pass the standard for market shipment and had to be tinned or discarded. The average loss was 20–40 per cent. in two counties and 10–30 per cent. in two others. In 1934 infested tomatos were found in fields near infested greenhouses in two localities in Mississippi. In infested greenhouses in one locality in Pennsylvania and in another in Delaware very serious injury occurred, resulting often in a loss of 50 per cent. of the crop and in several cases in complete loss. The nature of the damage is briefly described [**19** 654]. Incomplete data on the life-history in California from unpublished work by A. F. Howland show that the total developmental period from egg to adult varies from 28 to 145 days, with an average of 67. The oviposition period lasts 1–20 days, with an average of 5·9. There are probably a number of generations a year. *Apanteles scutellaris*, Mues., and *Sympiesis stigmatipennis*, Gir., were reared from pupae of the moth but the total parasitism was only 16 per cent.

No satisfactory method of control has been developed. The usual practice of abandoning infested fields and placing plants after harvest in piles along the edges of the fields and in neighbouring ravines results in the building up of large populations. Moths have emerged from such piles for over 4 months, so that adults from a late autumn or winter crop infest the following early spring crops. The fields should be burned over or ploughed up after harvest.

Armitage (H. M.). **Packing Materials as possible Plant Pest Carriers.**—*Bull. Dep. Agric. Calif.* **24** pp. 310–316, 1 fig. Sacramento, Calif., 1935.

The need for the enforcement of measures restricting the import of packing materials that harbour pests is discussed, and the existing

quarantine laws in the United States are described. Packing materials that carry pests can be classified as those that form a natural habitat for the insect but do not necessarily contain its food, such as soil; those that merely act as physical carriers, such as plant fibres, mosses, straw, etc.; and those that are the food-plants or parts of the food-plants of the pests. The plant materials used as packing mediums are restricted geographically to certain regions, so that if the origin of the shipment is known, the type of packing material and the possible pests that may be found in it can be anticipated. Many instances are given of pests actually intercepted at San Francisco in such packing materials. Safe substitutes for prohibited materials include peat, peat moss, fern fibre, paper, sawdust, ground charcoal and cork.

Friend (R. B.). **The European Pine Shoot Moth.**—*Bull. Dep. Agric. Calif.* **24** pp. 322–327, 6 figs. Sacramento, Calif., 1935.

Notes are given on the bionomics and control of *Rhyacionia buoliana*, Schiff., on pines in Connecticut [*cf. R.A.E.*, A **21** 98, 511; **22** 394; etc.]. It occurs in eastern Canada and over a wide area in the north-eastern United States and has been found in British Columbia, but in the United States is a pest in New York and Connecticut only [**22** 288]. Winter mortality of the larvae has been high during the last two years in Connecticut, so that it is unlikely that the insect will be a serious pest much further north than its present range.

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This is the first of a series of articles on the pests and diseases of coffee in Africa, particularly East Africa where they have been most investigated. The main object of the series is to collate information on modern control methods that is scattered in many publications.

Brief descriptions are given of the more important species, with notes on their bionomics to permit timely recognition and control, and lists are included of allied species that have been recorded on coffee, but not as causing any extensive injury to it. The pests dealt with are the Longicorns, *Anthores leuconotus*, Pasc., occurring in Angola, South-west Africa and throughout East Africa, *Bixadus sierricola*, White, in French Equatorial Africa, the Belgian Congo and Uganda, *Dirphya usambica*, Kolbe, in Tanganyika and Kenya, *D. princeps*, Jord., in Tanganyika and Uganda, *D. nigricornis*, Ol., in Nyasaland, *Tragocephala guerini*, White (*anselli*, Bates), in the Belgian Congo, and *Penhammus pauper*, Kolbe; some Anthribids of the genus *Phloeobius*; Bostrychids including *Apate monacha*, F., widely distributed in tropical Africa, and *A. indistincta*, Murr., in Tanganyika, Kenya, Uganda and Nyasaland; and the Cossid, *Xyleutes armstrongi*, Hmps., in Sierra Leone and the Gold Coast.

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